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Correspondence.—Wishing to make this JOURNAL a gazette of intelligent discussion to those of our readers who may wish to gain or give information on the subjects to which its columns are devoted, correspondence is solicited for publication from all who make the study of those subjects a pleasure or a profession.

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The Public Lighting Tables of the American Meter Company will be found in the page advertisement of that Company.

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[OFFICIAL NOTICE.]

May Meeting, Society of Gas Lighting.

OFFICE OF THE SECRETARY, May 4, 1896.

The May meeting of the Society of Gas Lighting will be held in the Arena, No. 39 West 31st street, New York, at 3 P.M. of the 14th inst.

FRED. S. BENSON,
Secretary.

[OFFICIAL NOTICE.]

Nineteenth Annual Meeting, Western Gas Association.

OFFICE OF THE SECRETARY, NEW ALBANY, IND., May 5, 1896.

The nineteenth annual meeting of the Western Gas Association will be held at Lookout Mountain, near Chattanooga, Tenn., May 20, 21 and 22, 1896, and will be called to order by the President, Mr. A. W. Littleton.

Lookout Inn will be the Association headquarters, and the business sessions will be held in a detached building, closely adjoining the hotel.

The rates at Lookout Inn will be from $2.50 to $4 per day, with a special rate of $2 per day for the wives of the members who may be present.

The Executive Committee met at St. Louis last January, and, as a result, the following papers will be presented for the consideration of the members:

"Self-Education in Gas Engineering," by Mr. Alex. C. Humphreys, New York City.

"Municipalities vs. Gas Companies: Their Reciprocal Relations," by General A. Hickenlooper, Cincinnati, O.

"The Future of the Gas Business in America," by Mr. M. S. Greenough, Cleveland, O.

"How will the Manufacture of Calcium Carbide Affect the Gas Business?" by Mr. Fred. Bredel, Milwaukee, Wis.

"The (Alleged) Law of Inverse Squares," by Mr. B. E. Chollar, St. Louis, Mo.

"Wrinkle Department," edited by Mr. Geo. T. Thompson, St. Louis, Mo.

"A Few Words on Naphthaline," by Mr. John Gimper, Galveston, Tex.

The Southern States' Passenger Association, Central Passenger Committee, Chicago and Ohio River Traffic Association, Trunk Line and Chicago and Alton R. R., from all points in Illinois, have granted the usual rate of 1½ fare, on the certificate plan, for the round trip to *Chattanooga*, conditional on 100 certificates being presented to the Secretary.

The territory embraced by the Southern States' Passenger Association includes all lines east of the Mississippi river and south of the Ohio and Potomac rivers.

The territory of the Central Passenger Commitee and the Chicago and Ohio River Traffic Association is bounded, on the east, by Pittsburgh, Salamanca, Buffalo and Toronto, on the north by the line of, and including points ont he Grand Trunk Railway from Toronto to Port Huron; thence, via Lake Huron and Michigan, to the north line of Cook county, Ills.; on the west, by the west line of Cook county and

the Illinois and Mississippi rivers to Cairo, including Burlington, Keokuk, Quincy, Hannibal and St. Louis; and on the south, by the Ohio river, but including all points on either side of that river.

The Trunk Line territory is as follows: From Niagara Falls, Buffalo and Salamanca, N. Y., Pittsburgh, Pa., Bellaire, O., Wheeling, Parkersburgh and Charleston, W. Va., and points east thereof, except in New England.

All persons availing themselves of the reduced rates will apply to agent at least 30 minutes before departure of train. Certificates in accordance with above arrangement will not be honored, returning home after May 26. All ticket agents do not have a supply of certificates, but they may be obtained by request, if notification is made in time.

The New England Passenger Association refused the request for reduced rates. All persons in the above territory, or territory not embraced by the Passenger Associations mentioned, will purchase tickets to nearest important station in one of said Associations, and from there purchase a first-class ticket to Chattanooga, paying for same full fare, receiving from the ticket agent a certificate stating that full fare had been paid to Chattanooga, which certificate must be given to the Secretary before the afternoon of Thursday, May 21, so that the Agent of Southern States' Passenger Association may sign certificate, which will entitle the purchaser of ticket to a one-third rate from Chattanooga, returning to the station from which ticket was purchased, providing 100 certificates are presented for signature.

All tickets must be purchased to Chattanooga, and *not* to Lookout Mountain. The various Passenger Associations grant reduced rates only to Chattanooga, from which place Lookout Mountain can be reached by the Chattanooga and Lookout Mountain R.R., which connects, at Union and Central Depots, with all the principal trains from the North and West. Mr. M. S. Gibson, Manager of Lookout Inn, agrees to take charge of all baggage at Chattanooga and relieve our members of the responsibility of rechecking. He writes as follows: "We shall have men at the Union and Central Depots in Chattanooga to receive the checks of your members when they arrive there, and take charge of their baggage, bringing it directly to the Inn, relieving them of all care and responsibility. Our standard gauge train leaves both the Union and Central Depots on the arrival of the principal trains from the North and West, so that passengers can be transferred directly from their trains to our train and taken to the Mountain in 40 minutes' time after their arrival. If the members or any of them arrive on trains that we do not connect with, our porters will be there to show them the way to the electric cars, which run every 15 minutes from the depots in Chattanooga to the foot of the Mountain, there connecting with the new 'Incline No. 2,' which will bring them directly to the door of the Inn, and is a very pleasant way of getting to the Mountain. These cars run every 15 minutes, from 7 A.M. to 10 P.M., and later if desired. All you have to do is to inform your members that, if they will make themselves known when they arrive in Chattanooga, we will see that they arrive at their 'haven of rest' without delay or difficulty. The fare from Chattanooga to Lookout Inn, via Lookout Mountain and Chattanooga Railroad, is 30 cents; round trip, 50 cents."

Mr. James Forbes, Chairman of Committee of Arrangements, announces that he or Mr. I. S. Post will meet the special train, which will be run from Cincinnati, under the direction of Mr. E. H. Jenkins, Supt. Gas Company, Covington, Ky. He will also meet the delegation from St. Louis. Mr. Forbes also states that "Incline No. 1" will give a low round trip rate, and will deliver all baggage from foot of "Incline" to Lookout Inn free of charge. Checks can be given to the Transfer Company's agent, who will also give a special rate from train to foot of "Incline No. 1," and return.

A meeting of the Board of Directors of the Association will be held at Lookout Inn, at 8 P.M., Tuesday, May 19. The following members are Directors: I. C. Baxter, Wm. McDonald, Geo. T. Thompson, Irvin Butterworth, W. M. Eaton, Geo. H. Harper, Peter Young, O. O. Thwing and Wm. Steinwedell.

The social part of the meeting will consist, on Friday, of a drive through the Park, arranged by the Committee of Arrangements. This cannot help but be interesting and instructive.

On Wednesday or Thursday evening a dance will be given at the Inn. Mr. Gibson will use every endeavor to make his guests comfortable, and all who attend will have every reason never to forget the nineteenth annual meeting of the Western Gas Association.

An invitation is extended to all members of kindred Associations to be present at our meeting and to participate in the proceedings.

The Question Box is ready to receive inquiries, and it is hoped many will avail themselves of the privilege it affords.

The President has appointed the following Committee of Arrangements: Messrs. Jas. Forbes, I. S. Post, Henry Clay Evans and T. H. Payne, of Chattanooga, Tenn.; Robt. Young, Knoxville, Tenn.; E. H. Jenkins, Covington, Ky.; and Jas. T. Lynn, Detroit, Mich.

The undersigned will be pleased to mail blank applications to any who may wish to join the Association and to reply to all communications concerning the meeting.

JAMES W. DUNBAR,
Secretary.

BRIEFLY TOLD.

NEXT WEEK, AT CHATTANOOGA.—The current notice, by Secretary Dunbar, respecting the Chattanooga meeting of the Western Association, shows that the paper list has an additional theme upon it, Mr. John Gimper, of Galveston, Texas, having consented to report some experiences in the instance of the naphthaline bugbear. Another change in the programme is the postponing of the Directors' meeting, from 2 o'clock of Tuesday, May 19th, to 8 o'clock of the evening of the same day. The amendment was found to be in order, through the time schedules of the fast trains reaching Chattanooga, so that a good attendance of the Directors could be reasonably looked for. Nothing has been left undone to insure the comfort of those who will participate in the meeting, and we have every reason to believe that President Littleton will have the satisfaction of directing a meeting that will be notable in the Western's history for a representative attendance, for positive advantage to the gas industry from a technical standpoint, and for abundant evidence of the fraternal spirit which animates, upholds and forwards the industry to which we all owe undivided allegiance.

THE MASSACHUSETTS PIPE LINE COMPANY.—Elsewhere in this issue we print the full text of the bill, reported by the Committee on Manufactures of the Massachusetts Legislature, by virtue of which the Committee puts itself on record as favoring the giving to Mr. Henry M. Whitney and his associates powers, in respect of the gas supply of the State of Massachusetts, that are beyond all reason. The bill proposes to charter the Massachusetts Pipe Line Company, ostensibly for the purpose of supplying "cheap coke and gas" to the residents of the State; but its real effect, if passed unshorn of any, or many, of its sections, would be to put the Whitney horde in position to "touch" the bank account of any man, woman or minor in the State who happened to have money invested in any legitimate gas enterprise there. Divested of its false pretense and misleading definitions, and its humbuggery in general, its baldness would indeed cause it to assume the importance of a shining mark; and so we hope it will prove—a mark so shining that every gas investor in the State will be tempted to take a shot at it. We presume that this "Pipe Line Company" is one result of the wretched contest that has been waged in Boston between the managers of the Bay State properties on the one hand and the backers of the Brookline interests on the other, a contest that has done more to interfere with the fair development of gas enterprise in the New England States than can be counteracted by a period of comity and peace lasting twice as long as the wretched contest lasted. We do not think that the Massachusetts Legislature will consent to the enactment of this offensive scheme, but the disquieting fact remains that the Committee on Manufactures consented to report the measure as fit for the serious consideration of the legislative body in general. Straightlaced (?) Massachussetts has often sighed over the queer things that have been done by the New York Legislature, but we have no hesitation whatever in saying that even the last New York Legislative Committee on "Miscellaneous Corporations" would have "laughed out of court" a bill similar to that which gave rise to this comment.

NOTES.—The proprietors of the Consumers Gas Company, of Reading, Pa., have just completed a remarkably successful exhibition of how to cook by gas, the demonstration having been carried on in the Company's handsome offices on North Fifth street. Mrs. Joseph Vasey and Mrs. Theo. Keppelman directed the practical end of the object lessons, and music, flowers and luncheon were the pretty and powerful incidentals of the exhibition.——At the annual meeting of the Easton (Pa.) Gas Company the officers chosen were: Directors, Samuel Boileau, Wm. A. Seitz and R. I. Seitz; President, Samuel Boileau; Treasurer, E. S. Lawall; Secretary, W. G. Stewart; Superintendent, Wm. H. Ward. ——It is possible that a receiver will be appointed for the Spencer (Mass.) Gas Company before the affairs of that corporation can be satisfactorily straightened out.——At the annual meeting of the Cincinnati (O.) Gas Light and Coke Company the following Directors were elected: General A. Hickenlooper, Robt. Allison, J. H. Bates, W. A. Goodman, A. H. Hinkle, Chas. Fleischman and G. N. Stone.

The Determination of a Light Unit.

By Mr. D. W. Murphy.

Within the past few years the determination of a light unit which should be suitable as a standard with which other light sources could be compared, has received no little attention in the scientific world. We are accustomed to define the amount of light given off by a source as being equal to that of some number of standard candles, by a standard candle meaning one that consumes a unit mass of wax, paraffine or other combustible substance in a unit of time. The amount of light from such a standard is necessarily a variable quantity, as it depends upon the purity of the substance consumed, and, as is the case with all flames, upon the meteorological conditions of the atmosphere. The former source of error can be reduced to a minimum by using a more defined substance; and corrections based upon experimental data can be made for atmospherical changes, reducing the results to standard conditions. The final test, however, for such a unit as a standard, is whether in the hands of different observers concordant results can be attained. This has not been attained by any form of candle yet used. Measurements upon a paraffine candle in use for many years and adopted as a standard in Germany show that these variations were not less than 10 per cent.

The principal requirements of a light unit that will be serviceable as a standard are, first, that it shall be constant, and second, that it be simple enough in construction that it may be readily reproduced. The first requirement is one of a purely scientific nature, and may aid in the solution of the problem from a practical standpoint just in proportion as the second requirement can be realized. Since no standard yet prepared has given constant results in the hands of different observers, various attempts have been made to find some more reliable source with which comparisons can be made. To this end various light units have been proposed; among the most prominent of these should be mentioned the Heffner lamp and the pentane lamp of Vernon Harcourt. These are both open flame lamps, the substance used in the first being amyl acetate and in the second pentane. M. Violle has proposed as a

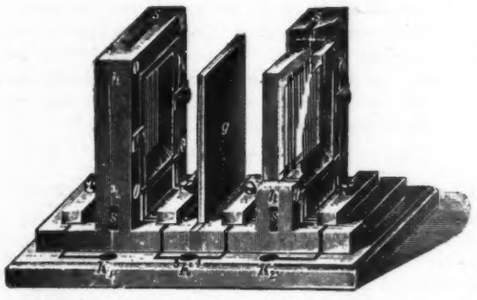


Fig. 1.—Scheme of the Lummer-Brodhun Photometer.

unit the light emitted from a square centimeter of platinum at its temperature of volatilization. This, while it would seem to promise good results, has not met with success in the hands of other observers. Another standard proposed independently by Professor S. P. Thompson and Mr. James Swinburn was to use the light given off from 1 square millimeter of the crater of the positive carbon in the electric arc lamp. None of the standards, however, together with the many more that have been proposed, have fulfilled the conditions required of a practical light unit. At the International Electrical Congress, held in Chicago in 1893, attempts were made to bring about the adoption of a unit. Of those considered by the Committee the Heffner and pentane lamp were the most promising. Objections were made to the Heffner lamp that the flame was yellow in color, and to the pentane lamp that the commercial pentane is not sufficiently well defined. Finally, the objection was made to all open flame lamps that they are too much affected by the temperature, pressure and moisture of the air.

The Committee recommended that while the members realized the great progress made by the construction of these lamps, yet it was unable to recommend either as a light standard. It further invited all nations to make researches in common on practical, well defined standards, in the hopes of realizing an absolute unit. Since that time some further progress has been made and other forms of units have been proposed. The most of these, however, are mere proposals of what may be a constant source, but lacking careful experiments to recommend them to favor.

The following method of determining a light unit and the one which seems to promise best results so far attained has been used by Professor Lummer and Dr. Kurlbaum, of the Physikalisebe Reichsanstalt. As a unit is used the light emitted from a square centimeter of platinum kept at a constant temperature. The platinum strip is heated by an electric current; the temperature is defined by the relation of the amounts of its radiations under different conditions. The one is the total radiation of the heated platinum, the other consists of the rays which pass through a definite absorption medium. So long as the ratio of these two remain the same the temperature of the course is constant. The amounts of these radiations are measured by means of the balometer. The principles of this instrument, the use of which has been far reaching in physical investigations, were first worked out by Suanberg, and later, but independent of him, by Langley.

The essential part of the instrument consists simply of a high resistance placed in an electric circuit. On this high resistance part of the circuit radiations are allowed to fall and the change in the resistance due to the temperature change measures the intensity of the radiations.

The apparatus used by Drs. Lummer and Kurlbaum consisted of a balometer, with galvanometer and other accessories for indicating changes in resistance, together with the light source, which consisted of a strip of platinum of approximately 25 millimeters wide, 60 millimeters long and 0.015 millimeters thick, so mounted that it formed part of an electric circuit. The platinum was heated to a high temperature by an electric current, whose strength could be regulated by a variable resistance. The light source was mounted on a form of optical bench, with two arms at right angles to each other. Upon the one arm the balometer was mounted, and upon the other a photometer. By rotating the light source, which was at the junction of the two arms, on a vertical axis, comparisons could be made either on the balometer for the intensity of the radiations or on the photometer for the light intensity. The photometer used was of the Lummer-Brodhun type; the light with which the standard was compared was an incandescent lamp burning under a current of low intensity.

Previous results show that by burning a lamp in this manner its intensity could be kept constant for a very long period.

The general scheme of the apparatus is shown by Fig. 1. A is a circular plate of marble upon which the platinum strip S is mounted. A is so made that it turns about an axis passing through its center. The platinum S is connected with copper electrodes, which are connected with the battery B. R is a variable resistance. In the one arm of the bench is the box O, which contains the balometer, which is connected on a battery circuit with the galvanometer G Between the light source and the balometer is placed the absorption cell C. This cell is supported on a movable screen, so that it may be carried out of the path of the ray when it is desired to allow the entire radiation to fall upon the balometer. On the other arm of the bench P and L represent respectively the photometer and the lamp against which the standard was compared.

Fig. 2.

The balometer was made in the following manner: A platinum plate is placed between two silver plates of some 10 times its own thickness; the plates are then passed through rollers, the distance between which is constantly decreasing. As the silver plates become thin they are strengthened by being placed between copper plates and the rolling continued until the platinum is of the required thickness. In this manner a coherent piece of platinum as thin as $\frac{1}{1000}$ millimeters may be obtained. For practical working, however, a thickness of about three times this amount was more satisfactory. The thickness of those used in the experiment was $\frac{1}{1000}$ millimeters. When rolled to this thickness the silver adheres firmly to the platinum and serves as a vehicle for handling it in a manner that would be otherwise impossible. The silver sheet is then mounted on glass with Canada balsam and cut on the dividing engine in the form shown in Fig. 2. The 12 strips are each 1 millimeter wide, 1.25 millimeters apart and 3.2 centimeters long. The plate often being cut in this form is mounted on a frame of slate, the extremities being soldered to copper electrodes. Fig. 3 shows the manner in which the mounting is done; c, d k, i is the frame of slate, w and w' the copper electrodes to which the extremities of strips are soldered. After the mounting has been done the silver is removed by immersing in nitric acid.

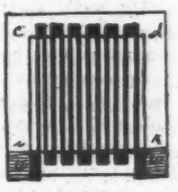


Fig. 3.

The surface of the platinum is blackened in order that it may absorb all rays received upon it. The blackening was done by means of platin

black, thrown down by electrolysis, in a weak solution of platin chloride.

The plate is removed from the glass by chloroform and fastened to the frame by means of resin dissolved in ether. To protect the extremities of the strips from the action of the acid they are covered with Japanese varnish and hydrochloric acid. Two balometers prepared as above described were placed one behind the other so that the strips of one covered the spaces of the other, thus forming a nearly continuous surface on which the radiations were received.

The two pairs of balometers were connected so that they formed the four arms of a Wheatstone bridge. The radiations fell upon the two opposite arms of the bridge.

The balometers mounted in the form for use are shown in Fig. 4.

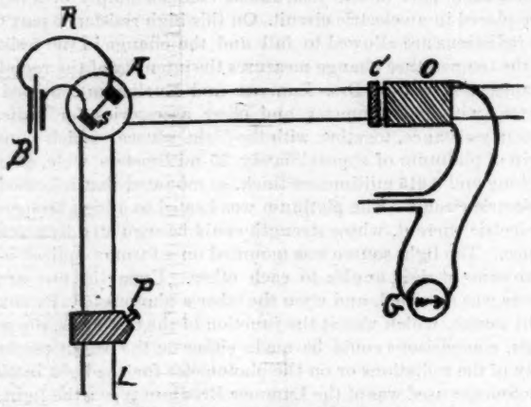


Fig. 4.—A Two-Pair Set of Balometers.

The two pairs are mounted in the hard rubber standards *h* and *h'*. The radiations fell upon them in *h*. The openings *S* allow air to circulate freely through the apparatus. The plate is of copper, blackened so that it will absorb all rays which fall upon it and serves as a screen to protect the balometers mounted in *h'*.

The absorption cell consisted of a ring of glass with sides formed of parallel quartz plates. The quartz plates were 1 millimeter thick and 2 centimeters distant from each other. The cell was filled with pure water.

The temperature of the glowing platinum was so regulated that the total radiation which fell upon the balometer was to that which passed through the absorption cell in the ratio of 10 to 1.

From a consideration of the curve of the intensity of radiations it is clear that this could be the case only when the temperature of the radiating source remained constant.

The amounts of the radiations were measured by the galvanometer deflections. Since it was impractical to work with deflections one of which was 10 times as great as the other, the deflections were made equal. For this three different methods were used. The first was to shunt the galvanometer so that only 0.1 of the current passed through when the total radiations were received.

The second was by changing the resistances of the entire circuit so that their values were in the ratio of 10 to 1 for the total and partial radiations. This method was practical for relative feet, not for absolute measurements.

The third method consisted in changing the distances of the balometer from the radiating source so that the distance for the total radiations was to that of the partial radiation in the ratio of the square root of 10 to 1.

At a fixed distance before the glowing platinum a diaphragm of exactly 1 square centimeter area was placed; the light which passed through this diaphragm was taken as the unit.

During the experiments the temperature of all parts of the apparatus, whose temperature change could affect the results, was kept constant by being inclosed in hollow-walled cases through which water was allowed to flow.

In order to reproduce this light unit it is necessary to measure accurately the size of the diaphragm and the thickness of the absorption cell, since these are the sources of error which most affect the results. Another, but very small inaccuracy, is introduced by a change in the thickness of the black on the balometer. It was found that a change of 50 per cent. in the thickness of this black gave a change of 2 per cent. in the light unit. This, however, is small when we consider that the process of blacking is based upon conditions quite readily reproduced, so that the errors in the thickness of the black may be made very small.

A series of observations made with different balometers prepared in the same way gave results, the greatest variations of which were 0.6 per cent.

The above method shows it to be possible to define a light unit in terms of absolute units. It is, however, only a definition and not an expression for the unit in absolute terms. As the term light involves not only the energy of the vibrating particle, but the physiological effect upon the retina, it is impossible to express a light unit in absolute terms in that manner that we are able to express a unit of work. It is therefore impossible to express it in terms of C.G.S. system, or at present in any known system, as we know that for lights of different colors the effect produced is not proportional to the energy of the vibrations. The difficulty then lies in the comparison of different lights with a standard.

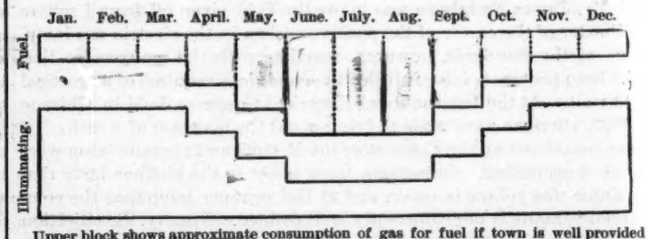
It is well known that one of the greatest difficulties in photometric work is the comparison of lights of different colors. The composite thing known as light is, according to the generally accepted theory, made up of the action of a large number of different vibrations. Each vibration produces a different effect upon the eye and the relations of the intensities of the different vibrations determine the nature of the light source. This is shown in the different spectre produced by lights of different nature. We do not know the relative values of different colors in terms of the effect they produce upon the retina. We are then unable to compare the values of the two complex quantities without knowing the relative values of their component parts.

In this sense we may say that a light unit is impossible; and so far actual experience has shown it to be true. Attempts have been made to solve the question by using different standards for different colored lights. This would in a way obviate the difficulty, but would give us no standard unit, but different units without a knowledge of their relative values.

Any complete method of comparing two light sources is one that will take account of all colors which are contained in the sources. This implies the valuation of the different colors in terms of their physiological effect in enabling us to see objects about us. A complete unit is one the component parts of which are known, so that the above comparisons can be made. We must therefore conclude that in its broadest sense we are very far from a complete solution of the problem of an absolute light unit, and so far that it is not even shown that in its complete sense such a light unit is possible.

Diagrammatic Outlining of Gas Sales on Fuel and Illuminating Account.

Mr. E. C. Hathaway, the progressive Superintendent of the Capital Gas and Electric Light Company, Frankfort, Ky., sends us a very interesting diagram showing the total amount of gas sent out from the works under his supervision, and the relative amounts used for illuminating and fuel purposes during the year 1895. He also incloses a diagram, issued as an advertisement by the Detroit Stove Works, which suggested the idea of outlining his returns in like manner. Mr. Hathaway notes the variation between the ideal rectangular lines set out in



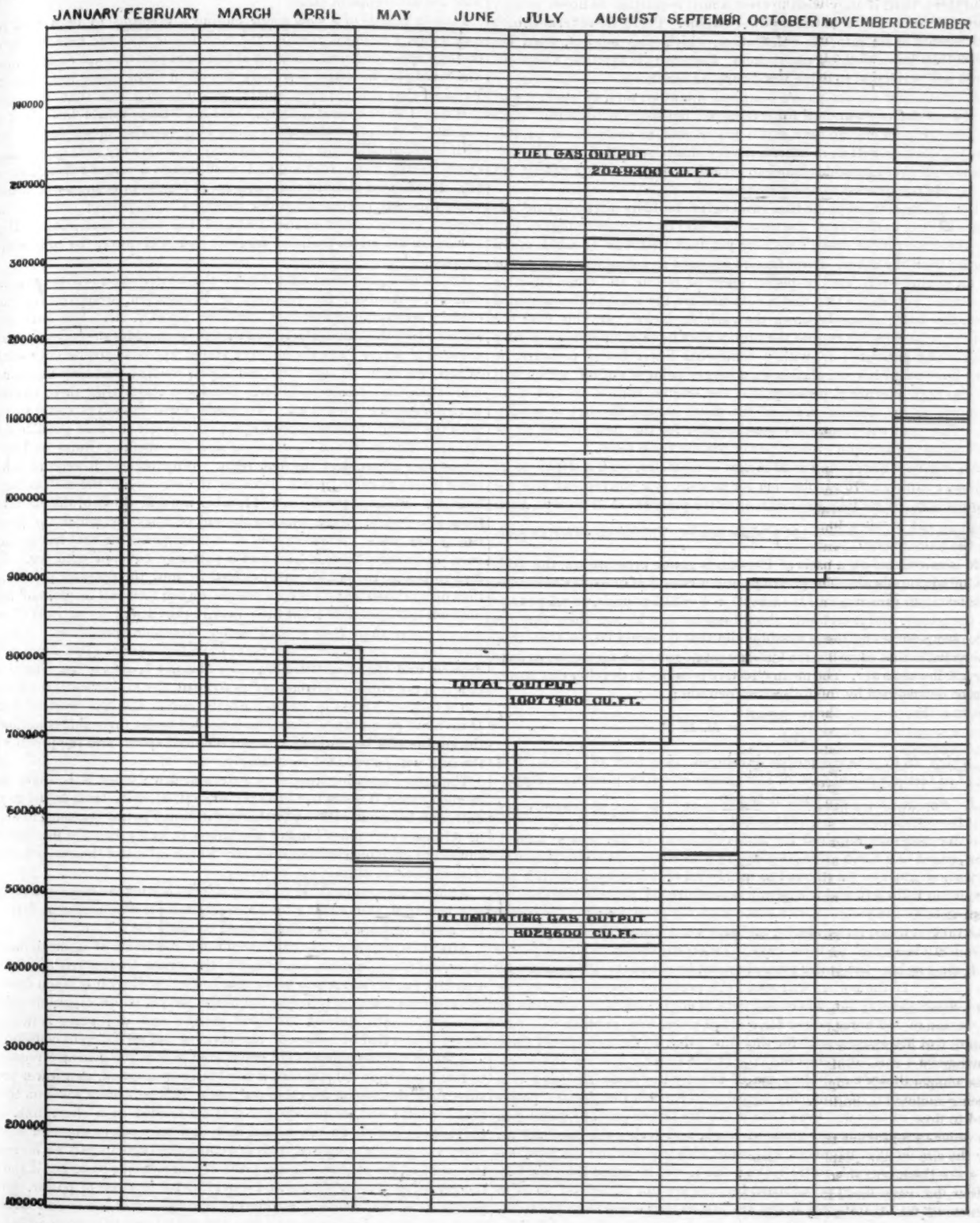
Upper block shows approximate consumption of gas for fuel if town is well provided with gas stoves. Lower block shows consumption for illuminating purposes. See how well they fit together and even up the consumption through the year. That's why there is a profit in fuel gas at a low price, and why it pays a Gas Company to crowd gas stoves even if they have to be placed free same as meters.

the advertisement and those produced in actual practice, and calls attention to the fact that as more fuel gas is sold in December and January than in November and March, the attainment of such even distribution as the advertisement outlines is well nigh impossible. We reproduce both diagrams for comparison.

By reference to the figures given, the proportion of gas sent out for fuel purposes at the Frankfort works was 20½ per cent. of the total output and 25½ per cent. of the amount distributed for illuminating.

These results are indeed flattering, and are a fitting tribute to the faithful, untiring and painstaking efforts which Mr. Hathaway has devoted to the interests of his Company, since assuming the duties of his present office four years ago.

The prevailing rates for gas consumed in Frankfort are $2 per 1,000 cubic feet for illuminating purposes and $1 per 1,000 cubic feet when used for fuel. The Company sells gas stoves at net cost, and sets them ready for use, free of any additional charge to the consumer. One hundred and fifty ranges now serve to lessen the labors and bring peace and comfort to their wise and fortunate possessors, and the outlook for a decided increase in the number during the ensuing months of 1896 is highly encouraging.



Points in the Selection of Steam Engines.

[By Mr. W. H. Wakeman, in *Engineering Magazine*.]

A great many engines are manufactured each year, and many of them, especially those of small and medium power, are purchased by men who are not judges of machinery. In purchasing an engine one of the most difficult points to settle is the size. This will surprise those who think that, if they wish to erect a mill requiring 40-horse power, they need only buy a 40-horse power engine. There are several things that should enter into the calculation, which they neglect, often because they know nothing about them. Especially is this true where engines are purchased to drive woodworking machines.

It is true that a horse power is a fixed quantity, and, as such, a perfectly satisfactory standard for reference; but there are different ways of designing an engine for a given power, and, as competition in this line of work as well as in others, is very sharp, some builders take advantage of every possible chance to give their engine a high rating, not always in the interest of the purchaser.

For illustration, suppose that two engine builders manufacture engines having cylinders of the same size, and that their catalogues call for the same rate of speed; we may yet find that one is rated much higher than the other. Three factors are used in calculating the power of an engine—*viz.*, area of piston, speed of piston, and mean effective pressure; but, as the two first mentioned are the same in the assumed case, the latter alone becomes the variable factor. In this case the builder who rates his engine the higher may have calculated on a very high boiler pressure; or, with a somewhat lower boiler pressure, he may have based his calculation on a longer point of cut-off, which will give so high a terminal pressure that the engine cannot be called an economical one, because much of the steam passing through it is wasted. This man will frequently get the order for the new engine, as he will agree to furnish a greater power for the same price.

An engine whose piston is 20 inches in diameter, with a stroke of 42 inches, running at 70 revolutions per minute, is a convenient size for comparison. If we take the mean effective pressure at 40 pounds, then we have $\frac{314 \times 490 \times 40}{33{,}000} = 186.5$-horse power. This mean effective pressure is calculated on a basis of 80 pounds gauge pressure on the boilers, or 95 pounds absolute pressure, and a cut-off at one-quarter stroke. The terminal pressure will then be $95 \div 4 = 23.5$ pounds, or 8.5 pounds by the gauge, and it certainly should not be any higher than this for economy; some engineers would claim that it should be less than this. The point is that some engine builders catalogue such an engine as having 250-horse power. The mean effective pressure to develop this power can be determined by the following formula:

$$\frac{H.P.\ 33{,}000}{AS} = M.\ E.\ P.$$

in which $H.P.$ = horse power developed, A = area of piston, S = speed in feet per minute, $M.\ E.\ P.$ = mean effective pressure. Applying the formula, we have $\frac{250 \times 33{,}000}{314 \times 490} = 53.6$, or, say, 54 pounds mean effective pressure required for a development of the power named. Now, to get this mean effective pressure with 80 pounds boiler pressure, the cut-off must be lengthened to nearly 0.4 of the stroke, making the expansion ratio 2.75 and the terminal pressure 35 pounds absolute, or 20 pounds by the gauge, which is too high for good results. In order to cut off at one-quarter stroke, and still get a mean effective pressure of 54 pounds—which we must have if we are to develop 250-horse power with this engine—the boiler pressure must be raised to 100 pounds by the gauge. If the boilers will stand this pressure, the engine may be used economically; but, where one firm of engine builders will furnish an engine of 186-horse power for a given price, and another will furnish one of 250-horse power for the same price, to the uninitiated there seems to be a vast difference in favor of the latter. Yet on investigation we find that the cylinders are of exactly the same size, and it is quite possible that the company agreeing to furnish the greater power for the same money will even then make the larger profit by putting in less stock, doing a cheaper grade of work, and giving the machine an inferior finish. No wrenches will come with this engine; the purchaser will have to buy a throttle valve; and it will be noted that the bottom of the frame and the outboard bearing are not planed off so as to rest solidly on the foundation, but are just as they came from the foundry. In setting the engine, it must be blocked up level and filled in with sulphur between the iron and the foundation, which is not the best method, although many engines are still so set.

Again, a steam user desiring a new engine may write to several builders asking for prices on a 200-horse power engine, and will be surprised at the prices respectively quoted by the manufacturers. Further investigation shows that the party asking the higher price expects to furnish a 20 by 48 engine, running at 70 revolutions per minute—which is not unreasonable—while another bidder expects to furnish a 16 by 36 engine running at 125 revolutions per minute. This calls for a mean effective pressure of 45 pounds, which, of course, can be secured; but note the difference in speed.

I am in charge of a slow speed engine. Wishing to be absent for half a day, I engaged to run it for me a friend who had been employed on high speed engines. Looking at the sight feed oil cups on the guides and wrist pin, he asked how long the oil in them would last, to which I replied that at night they would be something less than half full. "Where I have been employed," said he, "they would last about 20 minutes." It is true that his engines were running much faster; but, with slight modification, this illustration will do very well here. High speed means more friction, and that means a larger expenditure of oil. It has been claimed that high speed results in economy of steam; while this may be true when the machine is in perfect order, the increased friction soon causes leaks in the valves and piston. High speeds are not an unqualified success, and will never be universally adopted.

Let us now give some attention to the power required to run machinery. Assume, for purposes of illustration, woodworking machinery consisting of matcher, surfacer, rip saw, etc. We have been informed by their manufacturers that these machines require a certain amount of power; but the amount stated appears surprisingly small. When we come to use these machines, we find that they take much more than the estimate calls for. Shall we claim that their builders were dishonest? Not at all. No doubt these machines could be run with the stated amount of power, but only under the best possible conditions. The knives of the matcher and the surfacer must be sharp, the lumber clean, and the cut light. Why should it require much more power to drive them? Because the service in the mill is much heavier. Perhaps poorly sawed lumber must be dressed, the cut being from $\frac{1}{4}$ to $\frac{1}{2}$-inch. Such was not the sort of work for which the power rating was made. Another load of lumber comes in that has perhaps been unsheltered from storms and is partially covered with ice. The feed-rolls slip, the boards will not feed in, and the operator puts shavings on the boards and his own weight on the feed-roll levers, and thus makes a little progress; but the power required will be at least 25 per cent. greater than that needed under favorable conditions. After a time, the knives get dull; but there are a few hundred feet more to be dressed, and after that there are some nice dry boards to be planed, so that it is not considered good policy to grind the knives until the rough job is finished; rosin is put on the belts, and at last the work is done. If no more power is provided than is needed under favorable conditions, the engine will be running at about one-half speed, and the product of the mill will be reduced accordingly.

The same reasoning applies to a circular saw; when it is sharp and in good order, it needs but little power, but, after its teeth begin to get dull, and before it will pay to sharpen it, much power is needed to drive it. Almost every other kind of machinery is, in a greater or less degree, subject to variable conditions—a fact which indicates that it is always wise to have an abundance of power.

Another important thing to be considered is whether more machinery will be added, thus calling for more power than was needed at first; if this seems probable, provision should be made for it.

After this article was begun, the master mechanic of a large manufacturing establishment mentioned to the writer that, when his engine was first put in, about two years ago, indicator diagrams taken from it showed that it was developing 259-horse power, while diagrams taken within a month showed 591-horse power; and still more is needed. Steam is supplied by boilers of various ages and on different conditions; and, as one of the oldest is not considered safe at the pressure required to run the engine (90 pounds), it has been cut out, and, at a lower pressure, furnishes steam for other purposes. This puts more work on those that are left; and, as more power will be needed in a short time, the old boilers are to be taken out, and new ones put in that can safely carry 125 pounds' pressure. It is not considered safe to further increase the speed of the engine. This is probably an extreme case, but it shows the necessity of anticipating and providing for increase of power. Such provision may be made by estimating the capacity of the engine with a short cut-off, and using boilers that will, with from 10 to 20 pounds less than they may safely carry, deliver the power at first needed. The speed of the engine may be lower than its safe limit, and, when more power is required, the point of cut-off will be lengthened automatically.

When an economical limit has been reached, the boiler pressure may be increased to the safe limit, and, when this will not supply the power needed, the speed of the engine may be increased, the main pulley taken off, and a larger one put on, so that the speed of the jack shaft will remain constant. If the engine has been run as a non-condensing engine, an independent condensing apparatus may be added—provided water is available—which will remove some of the useless work, and enable it to do more useful work.

In some cases it is advisable to commence with a single cylinder, making provision for another by having the crank shaft fitted for a crank on the other end of it; when much more power is needed, the other cylinder may be added. This may be made much larger than the first cylinder, thus making a compound engine of it, or it may be made of the same size, thus making it a double engine.

In these days of high pressures and fast speeds it is very necessary that an abundance of material should be used, in order to prevent undue springing of the parts, which, if it occur, will cause great friction, excessive wear and frequent failures. The attention of prospective purchasers should be directed to the fact that some engines are not made strong enough for the work that they are intended to do. The frames of some of the long-stroke engines are made without central support, and so light that they spring downward in the middle at every revolution of the engine. There can be no excuse for such defects.

The crankshaft of a certain large engine in the city of New York was made so light that, when the weight of the flywheel was put upon it, there was a deflection of about one-eighth of an inch at the center. In consequence of such defects the weight is very unevenly distributed on the bearings, nearly the whole of it being thrown upon their inner edges, thus greatly increasing the liability of the shaft to fracture. The purchasers drove a very sharp bargain with the builders, who are located in a Western city, and who finally made a price less than nearer builders; but in this case, as in other cases, the purchasers got what they paid for, and nothing more. It is not good business policy to pay an exorbitant price for an engine, but it is good business policy to pay a fair price for value received. The engine in question would develop the power called for by contract, but only on a basis that permitted no allowance for variations in boiler pressure; at no time was power developed on an economical basis.

The builders of medium and large sized engines should be required to guarantee a certain duty for their machines, as builders of pumping engines are required to give guarantees. It is true that these guarantees would not read alike; while the pumping engine is usually guaranteed to do a certain number of foot-pounds for 100 pounds of coal burned under the boilers, or for 1,000 pounds of steam passing through the engine, the factory engine is guaranteed to develop a horse power with the consumption of a certain number of pounds of steam per hour; but this amounts to the same thing in the end. Why so little attention is given to this matter may be partially explained by the fact that in some cases the desire for getting an engine at the lowest possible first cost is the controlling motive.

Suppose that one 600-horse power engine develops a horse power with 13 pounds of steam per hour, while another requires 15. Here is a difference of but 2 pounds per horse power per hour, or 1,200 pounds total per hour. Even if we have boilers that will evaporate 10 pounds of water with 1 pound of coal, this means a difference of 120 pounds of coal per hour, or 1,200 pounds per day, making 180 tons per year, which, at $3.50 per ton, amounts to $630.

Although an engine that makes good a builder's guarantee is very desirable, especially if a high duty is warranted, yet there are other things to be taken into consideration along this line; for an engine that is very economical when new may be wasteful of steam after a few years, owing to poor design or imperfect workmanship. This is a point that can be settled only by careful observation of the behavior of different types of engines after years of service. Upon this point the advice of an honest, competent consulting engineer is valuable.

It was formerly claimed by several engine builders that the plain, flat slide valve was superior to all others, because, as both valve and seat were flat, the longer it was run, the tighter it would get. I have not seen this statement in any catalogue for some time, and consequently believe that the theory has been exploded. When the power that moves a slide valve is applied on a plane above the seat, the valve will wear more at the ends than in the middle, and hence become leaky and wasteful of steam. One method employed to prevent this is the use of a pressure plate to hold the valve to its seat and yet allow it to slide. It is possible to so adjust a plate that it will do this; but such an attachment requires a very close adjustment—much too fine and close for what might be called "rough-and-tumble use." The flat valve can easily be planed off, filed and scraped to a fit, and its seat may also be so treated; but at the same time we should not lose sight of the fact that the valve seats of Corliss engines, and of some other types, may be bored out with a good boring bar, and the valves turned up in any lathe that is worthy of the name.

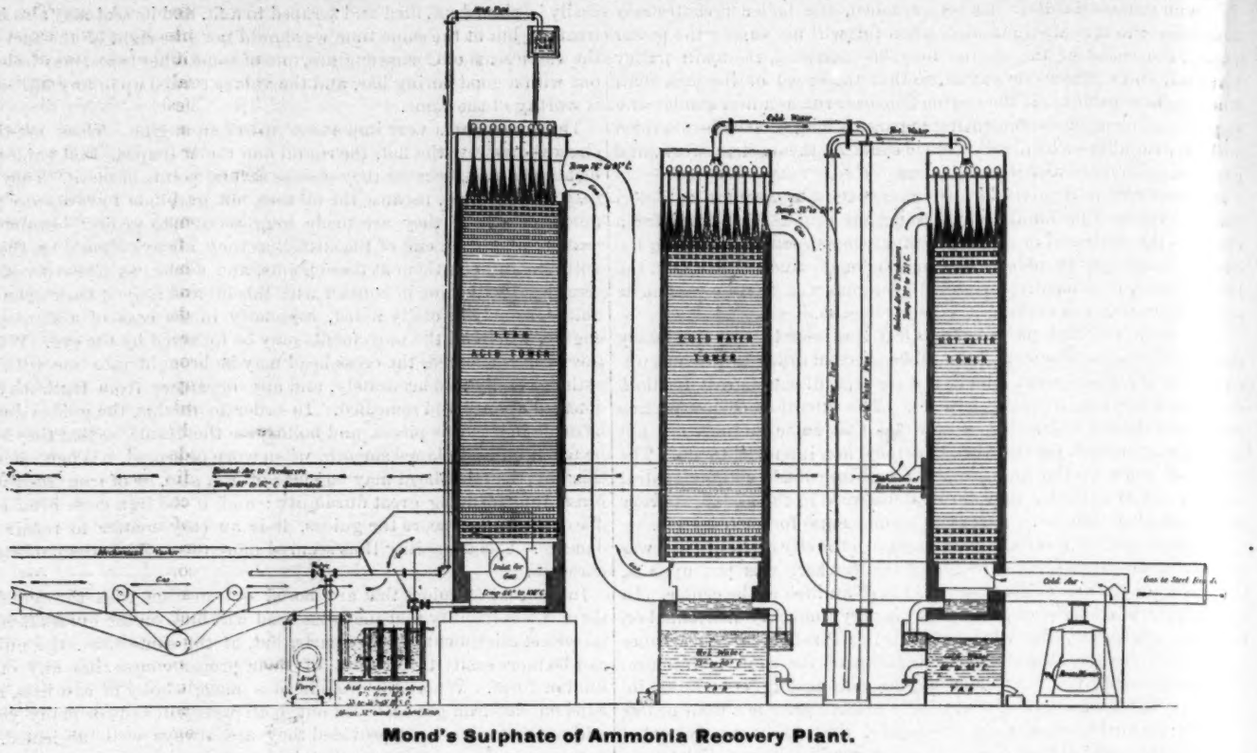
The guides are a very important part of an engine. There are three classes—namely, the flat, the round and the V-shaped. Flat guides are mentioned first, because they possess several points of merit. They are easy to keep oiled, because the oil does not gravitate towards any particular point. If they are made long enough to project beyond the cross-head at each end of the stroke, as they always should be, the oil will remain upon them at these points, and, as the engine revolves, the cross-head will come in contact with this oil and draw it back upon the guides, as may be easily noted, especially in the case of a slow-speed engine, where all the movements may be followed by the eye. Where this form is adopted, the cross-head may be brought into line with the cylinder easily and accurately, and any departure from truth may be detected at once and remedied. In order to do this, the guides should be made in separate pieces, and bolted on the frame, so that they may be taken off and planed smooth, when worn or scored. When made in this way, the cross-head may be made of iron also, or of iron lined with brass, thus insuring great durability; and, if the iron cross head ever does run dry and score the guides, it is an easy matter to repair the damage. The durability thus secured more than offsets the liability to abrasion.

In the case of guides that are bored out in line with the cylinder, there is less liability that the cross-head will bind on the guides though imperfect alignment of other parts, but, at the same time, the guides can be more easily thrown out of their proper course than any other kind or form. Where the cross-head is made wholly of cast-iron, and runs on cast-iron guides bored out, both parts will last for many years without excessive wear, provided they are always well lubricated. I have seen guides of this type that had been in use for two years, on which the toolmarks were still visible, showing that the wear was unworthy of mention; but, if such guides are ever allowed to become partially dry, they commence to cut without warning, and the whole surface is ruined at short notice. One trouble with them is that the oil put on them gravitates towards the lowest point and tends to leave the high parts without lubrication.

The V-shaped guides hold a cross-head rigidly in place—a fact which is almost their only recommendation. As frequently made for Corliss engines, these guides are cast in one piece with the frame, and the cross-head shoes are lined with Babbitt metal, consequently the guides are seldom found to be cut or scored, for the Babbitt metal will melt out, if neglected too long. The redeeming quality with this arrangement is that the Babbitt metal may be easily replaced. As a rule, the upper and lower cross-head shoes are interchangeable, so that, with an engine running "over" when the lower one is damaged or worn out, the upper one may be put in its place for a time. This form of guide needs more lubrication than any other kind, for all oil placed on the upper part of the V rapidly finds its way to the bottom, leaving the higher parts dry.

There are two general plans for putting a wrist-pin into the cross-head; one is to cast it in, thus making it solid with the cross-head, and the other is to bore a hole through the cross-head, turn up the pin, and drive it in. In the former case, after the engine has been run for several years and the pin is worn out of round, it is a difficult matter to repair it, without special machinery. In the latter case, the pin may, in a lathe, be made as round as it ever was. The objection to this arrangement is that sooner or later wrist-pin boxes will be accidentally keyed up tighter than they should be, with the result that the pin, being in a round hole, is loosened in the cross-head. No wrist-pin should be accepted, unless it is either cast in, or solidly keyed into the cross-head at both ends of the pin.

If a piston rod were always perfectly in line, and would never wear out of truth, it would be a much more simple matter to provide stuffing box packing. Under existing conditions we must have packing of various kinds to suit different cases. The use of fibrous packing concerns the economical operation of a plant more than it does the selection of the engine; but, in passing, it may be said that metallic packing is preferable. It may seem rather expensive at first, but it pays in the end by saving in the cost of soft packing, and by obviating unnecessary wear. For an engine of which I once had charge, which was fitted with metallic packing for the rod, an arbor was turned the exact size of the rod, and the packing nicely fitted to it. After the rod had been in use for nearly five years, a comparison of its size with that of the arbor showed that the rod was smaller than the arbor, but not more



Mond's Sulphate of Ammonia Recovery Plant.

than $\frac{1}{16}$ inch. Metallic piston rod packing is a paying investment, and it is wise to specify it when the engine is ordered. Every engine should have a properly designed and well built flywheel. When fly wheels burst, they are capable of doing great damage to life, limb and property. A flywheel should have metal enough in the rim not only to make it stiff enough for everyday use, but also to prevent it from springing outward between the arms, for it has been demonstrated that this action does take place at high velocities. The distance between the arms at the rim should not be excessive. No inflexible rules covering every set of conditions can be given, but one point must not be overlooked—namely, the speed of the rim; this should never exceed 4,800 feet per minute, or 80 feet per second, for any form of cast-iron wheel. Although some wheels exceed this safe limit, it is better to be on the safe side. If the governor fails to work properly for a few seconds only, the safe limit of speed is soon passed. Every engine should have a stop motion of some kind on it, so that, if the governor belt breaks or runs off from its pulleys, the engine cannot run away. The too frequent flywheel failures have also demonstrated that provision for automatically shutting off steam when regular speed is exceeded and the governor belt is in place should be supplied. I have thus presented the principal points to be considered by those who contemplate purchasing engines, and which practice and observation have shown to be essential to satisfactory results. Their observance will aid in preventing unprofitable investments and subsequent annoyance.

Mond's Combined Gas Producer and Sulphate of Ammonia Recovery Plant.

Engineering and Mining Journal remarks that at the chemical works of Brunner, Mond & Co., Northwich, England, there is in operation a plant for the simultaneous generation of producer gas and the manufacture of sulphate of ammonia from the nitrogen in coal. This plant is the invention of Dr. Mond, and is the result of many years' study of the important problem of obtaining large and cheap supplies of sulphate of ammonia. So completely has the problem been worked out that not only is a maximum amount of ammonia obtained from the coal, but a producer gas of high calorific value is generated.

Before commencing to describe the plant in detail, it may be said that every possible point of efficiency and economy has been studied, such as the design of the producer furnace in order to use the cheapest fuel, the provision of scrubbers to remove all dust and tarry matters, the recovery of waste steam and the utilization of the heat of the gas. The accompanying illustration shows in a diagrammatic way the design of the plant.

The experiments of Dr. Mond showed that the yield of ammonia in the producer varied with the temperature and that it was highest when the producer was worked as cool as was compatible with a good combustion of the fuel. It was also found to depend on the amount of steam introduced into the producer, and the most favorable results were obtained by introducing 2½ tons of steam for every ton of coal consumed.

Under these circumstances it mattered little what kind or quality of fuel was used, and common slack from the local coal fields answered perfectly well. About 70 per cent. of the nitrogen contained in the coal is recovered, yielding 90 lbs. of sulphate of ammonia to the ton. The fact that so much steam had to be used is at first sight against the process, but Dr. Mond has arranged the plant in such a way that a large proportion of the excess steam and its heat is recovered. When it is mentioned that only one-third of the steam used is decomposed and the other two-thirds passes away with the gas it will be seen that the problem of recovering it was by no means simple.

The gas producers are cylindrical in shape and taper at the bottom. In the producer as used in practice about 24 tons of fuel are gasified every 24 hours. The dimensions of the producer are 10 ft. diameter or 21 ft. high. Toward the bottom of the producer casing the sides taper inward and end in a conical grate. This grate has a round opening in the center through which the ashes descend into a water lute. The upper portion of the producer has a cone and hopper for introducing the fuel, and underneath the cone is a bell-shaped casting about 7 ft. long which is kept partially filled with fuel. The casing of the producer consists of two wrought iron shells, and air saturated with steam is blown into the annular space between them. The air and steam after being thus distributed and heated, pass through the conical grate into the fuel. The producer is kept filled up to the bottom of the bell-shaped casting. When fuel is introduced it is first of all distilled as in an ordinary gas retort inside the bell-shaped casting. The gases given off are obliged to force their way downward through the hot fuel, and during their passage the tarry vapors become fixed and give no further trouble. The gas on being taken off from the producer at a temperature of 450° to 500° C. is made to pass up and down a series of wrought iron pipes before going to the washers. These pipes are surrounded by annular casings, which are protected from the air by some non-conducting material. The steam saturated air coming forward to the producer passes through these annular casings, and is heated in there by the head of the producer gases, and so a considerable amount of heat is returned to the producer. As regards the producer, the lining lasts a very long time and little clinker is made, on account of the low temperature at which it is worked.

After passing through these pipes the producer gas is led through a chamber which is partially filled with water. This water is beaten into spray by revolving beaters, and the spray thus formed washes the dust and soot from the gas. The gas is reduced in temperature in this chamber to about 100° C., and it is further loaded with water vapor from the spray. The gas is then passed through a leaden scrubber which is filled with perforated bricks. This chamber contains the sulphuric acid for absorbing that ammonia. In practice it is found best not to use pure acid, but to keep in circulation a fairly concentrated solution of sulphate of ammonia, say 36 per cent. strength, which contains about 2½ per cent. of free acid. At regular intervals a certain proportion of this solution is withdrawn and the sulphate of ammonia recovered, the free acid being pumped back. After the gas has passed through the chambers its temperature is as low as 80° C., and as it is not fully saturated with moisture, no condensation takes place. The gas is then passed to a second scrubber constructed of wrought iron and filled with perforated wood blocks. In this it meets a current of cold water which condenses the steam, which heats the cold water to about 78° C. The gas is cooled to 50° C. in this chamber, and passes from it to the various places where it is to be consumed. The hot water in the chamber is pumped into a third scrubber of wrought iron, through which a current of cold air is forced in an opposite direction to the water. This air gets saturated with moisture and becomes heated to about 74° C., and is afterward forced back to the producer. The water leaves this third scrubber cold enough to be used again on the second scrubber. In this way about half the steam required in the producer is recovered from the gas, the rest being supplied from the exhaust of steam engines on the premises.

The producer gas in a dry state contains by volume 17 per cent. CO_2, 11 per cent. CO, 27 per cent. H, 42½ per cent. N, 0.4 per cent. olefines, and 1.8 per cent. methane. The fuel used is a common kind of slack, and contains 33½ per cent. of volatile matter, including water, 55 per cent. of non-volatile carbon and 11½ per cent. of ash. The calorific value of this gas is stated to be 80 per cent. of that of the fuel used, but the exact significance of this figure is not quite clear. At Brunner, Mond & Co.'s works 10 of these plants are now in use, and the average cost per ton of sulphate produced is about £4 5s., the value of the gas being, of course, deducted from the cost of the coal. The profit is, therefore, considerable at the present price of £8 10s. per ton. The initial cost of the plant is large, viz., about £20,000 for a plant to produce 4 tons of sulphate of ammonia per day, but the cost is not so great as that of the recovery plant used in connection with blast furnaces.

The Production of Caustic Soda and Bleach by Electrolysis.

Engineering says that the manufacture of caustic soda and bleaching powder by the processes in ordinary use is both costly and objectionable. It is costly owing to a large proportion (about five-sixths) of the chlorine contained in the salt—which is the base of the manufacture—being lost, and it is objectionable on account of the poisonous gases evolved, the noxious waste produced, and the insanitary character of some of its details. As caustic soda or bleaching powder are the principal chemicals employed by soap makers, paper makers and bleachers, and are used by them in large quantities, they constitute very expensive trade items. In order to obviate the objectionable features mentioned, the aid of electricity has been invoked, and many attempts have been made to obtain these two important chemicals in a direct, inoffensive and economical manner from common salt by electrolysis. Owing to causes of which it is unnecessary here to say more than that they were technical, these attempts have, as a rule, resulted in failure. The exception to that rule is the process originally patented in 1890 by Colonel T. J. Holland, C. B., and Mr. James C. Richardson, which was first put in operation on a working scale a few years since at one of the largest paper mills in the kingdom. It was worked there continuously, day and night, for two years, during which period it was developed into a practical commercial system. The time having arrived when it was desirable to enter upon the manufacture of caustic soda and bleach by this process on an extended scale for the market, a suitable site for the works was sought. One was eventually found at St. Helens, Lancashire, which is conveniently situated for obtaining the raw materials (salt and lime) as well as fuel, and which affords the necessary facilities for distributing the manufactured goods.

The works, which are owned by the Electro-Chemical Company, cover about 3 acres of land out of a site of 15 acres, thus leaving ample space for extensions. They are intersected by lines of railway connected by a siding with the London and Northwestern Railway system, and have a good wharf on the St. Helens and Mersey Canal. The process of manufacture is exceedingly simple and interesting, the caustic soda and the bleaching powder being produced without any loss of chlorine or waste of labor, by the decomposition of salt by an electric current. Rock salt is used, which is obtained from Cheshire, and is dissolved in the brine house. It is first placed with water in a tank in which it is agitated by revolving stirrers until the water has attained the highest point of saturation. The brine thus formed is run off into settling tanks 7 ft. 6 in. square in plan by 8 ft. deep, where the insoluble portions of the rock are deposited. From thence it is pumped up into a final settling tank 30 ft. above the level of the others, and from which it is supplied by gravitation to the decomposing tanks. These are situate in the tank house, a building 70 ft. long by 50 ft. wide and 40 ft. high, in which are 200 decomposing tanks of a special patented design, arranged in 10 sets of 20 each, superposed one tier above another and approached from galleries at three different levels. The brine from the final settling tank can be admitted to any set or group of decomposing tanks, or to a single tank, independently of the others. These tanks are each 20 ft. long by 3 ft. wide and 1 ft. 3 in. deep, and are divided into 32 compartments or cells, 16 for the anodes and 16 for the cathodes. The anode cells are hermetically closed at the top, but their dividing walls are not carried quite down to the bottom of the tank. The cathode cells are open at the top. The anodes consist of small blocks of ordinary gas retort carbon, set in lead backs, whilst the cathodes are simply cast iron grids. The anodes last about eight months with continuous day and night working. The current from the dynamo is led into the brine at the anodes, where chlorine gas is given off, which passes through a port-hole into a closed conduit running the whole length of the tank, and communicating with a horizontal stoneware main at the end of each tank. The current passes through the brine to the cathodes, and is thence led back to the dynamo by a return cable which completes the circuit. From the open cathode cell hydrogen gas is given off, and escapes harmlessly into the air.

As the decomposition of the brine progresses, the solution gets stronger in alkali and weaker in salt. The normal strength of the solution has, therefore, to be maintained, and this is effected by feeding common salt in, by a special method, at a pocket at the end of each cathode cell. The result of the evolution of the chlorine and hydrogen gases is the formation of a solution of caustic soda, which is drawn off when it has reached a given strength namely, from 50° to 60° Twaddell, when it contains about 12 per cent. of alkali. This solution is run off into shoots, and is conducted to receiving tanks in the caustic shed.

The brine has now been split up by electrolysis into chlorine and caustic soda, each of which is conducted to a department in which it is treated, the one for conversion into bleaching powder and the other for reduction by evaporation to the caustic soda of commerce. To form the bleach the chlorine is absorbed into lime in lead-lined chambers, of which there are three, and a fourth is in course of construction, each being 80 feet long by 25 feet wide, and 6 feet high inside. The lime, which is obtained from Buxton, is first slaked, and then put through two sieves or riddles in succession, the first riddle having a ¼-inch mesh and the second 484 meshes to the square inch. Both riddles are cylindrical, and are revolved at high speeds. The lime from the first riddle is lifted by an elevator to the second, and from the latter, by another elevator, to the stores. The floors of the bleach chambers are laid with Staffordshire tiles, and upon these the lime is laid, to a depth of from 4 inches to 6 inches, in ridge and furrow. The doors are then luted up and the chambers made air-tight in every respect, after which the chlorine is admitted at two points in the roof of each chamber. The gas, being heavy, has to be exhausted from the decomposing tanks by an aspirator through stoneware pipes, and is driven by the same means into the bleach chambers. There is also a wood fan, 5 feet in diameter, which is used alternately with the aspirator. The supply of chlorine is continued to the chambers for four or five days, according to circumstances, by which time the lime has absorbed the requisite quantity of gas. The combination forms chloride of lime, or standard bleach, containing 36 per cent. of chlorine. The product of each charge is from 20 to 25 tons of bleach, which is discharged through shoots in the floor of the chamber into casks, and packed ready for the market.

The second product of electrolysis, the solution of caustic soda, is stored in two cylindrical iron tanks, each 28 ft. long and 7 ft. 6 in. in diameter, placed in the caustic soda shed. This building is 83 ft. long by 45 ft. wide, and contains nine 12-ton cast iron caustic pots, heated by furnaces. The liquor is run from the tanks into these pots, in which it is evaporated down to the required density—*i. e.*, containing about 30 per cent. of alkali. Having reached this density, the liquor is still further evaporated down to the ordinary crystal caustic of commerce.

It is then, while still fluid, filled into iron drums of various sizes, in which it quickly sets solid, and is ready for the market. A small percentage of salt comes over with the solution from the decomposing tanks, and in the early part of the evaporating process this salt is removed and returned to the cells to make good the deficiency caused by decomposition before referred to, leaving, it is said, the caustic soda as pure as has ever been made by any known process.

The current is produced by two of Parsons' turbo-dynamos of 1,100 electrical horse power combined, placed in an engine house 60 ft. long by 30 ft. wide. They have separate condensers, and work at 120 volts and 3,750 amperes distributed into 5 circuits of 750 amperes each. The current is conducted to the decomposing cells by a tapering cable. This highly ingenious device, which is the subject of one of the latest patents, is 1¼ in. in diameter at the dynamo, and consists of 16 strands. Each tank contains 16 positive cells, and at the tanks a strand is led to each cell, so that the cable is tapered down to a single strand at the end of each tank. The adoption of this tapering arrangement enabled a saving of about £600 to be effected in the cost of the present installation. Steam is generated by means of five Lancashire double-flued boilers, each 30 ft. long by 8 ft. diameter, with 3 ft. 3 in. flues, working at a pressure of 160 lb. per square inch, and of 400-horse power, placed in a boiler house 60 ft. long by 60 ft. wide. Besides driving the dynamo engines and the circulating pumps for the condensers, steam is required for driving the engines for the lime mill, the agitators, the gas exhausting engine, and for steaming purposes throughout the works. The fuel used is a good coal from the Haydock coalfield, which only costs from 3s. 6d. to 4s. per ton delivered on the Company's sidings. The chimney shaft is 175 ft. high and 65 ft. in circumference at the base. Two main flues are led into it, one from the boilers and the other from the evaporating plant. The output of the present works when in full operation is about 160 tons of bleach and caustic soda per week. The plant, however, is being doubled, and it is to be quadrupled during the present year. The products are on the market, and from their purity and high quality command a ready sale. The process—which we have recently been afforded the opportunity of inspecting—is at once ingenious, simple, and efficient, and is economically worked, whilst the plant itself is by no means costly. The system is a great improvement in every respect upon the older methods of manufacture, and will, doubtless, in the end tend to considerably reduce the price of caustic soda, bleach, chlorate of potash, chloroform and all chlorine products.

Text of the Proposed Act to Incorporate the Massachusetts Pipe Line Company.

The following is the text of the Act reported by the Committee on Manufactures of the Massachusetts Legislature, resulting from the petition of Mr. Henry M. Whitney and associates for authority to furnish the people of Massachusetts with "cheap coke and gas":

An Act to Incorporate the Massachusetts Pipe Line Company.—Be it enacted by the Senate and House of Representatives in General Court assembled, and by the authority of the same, as follows:

SECTION 1. Henry M. Whitney, Henry F. Dimock, Fred S. Pearson, James Phillips, Jr., Albert N. Parlin and George B. M. Harvey, their associates and successors, are hereby made a corporation under the name of the "Massachusetts Pipe Line Company," for the purpose of manufacturing, buying, selling, dealing in, conveying, transporting and distributing gas for illuminating, heating, cooking, chemical, mechanical and power purposes, and for such other purposes as may be incident thereto, with all the powers and privileges and subject to all the duties, restrictions and liabilities in all general laws which now are or may hereafter be in force applicable to gas companies, except as hereinafter expressly provided. And all the rights, privileges and franchises herein granted to do several things shall be construed as granting the right, privilege or franchise to do any or all of such things, and to do the same from time to time, except as hereinafter provided.

SEC. 2. The following terms wherever used in this Act shall have the application and meaning hereinafter set forth, unless some other meaning is clearly apparent from the language, context, or manifest intent.

The word "Company," or a pronoun in place of it, shall be taken and construed to mean the Massachusetts Pipe Line Company hereby incorporated.

The word "gas" shall be taken and construed as a general term for that commodity without reference to its illuminating power.

The words "illuminating gas" shall be taken and construed to mean gas of the purity and illuminating power required by general law, intended to be used for illuminating purposes by simple ignition at the burner.

The words "fuel gas" shall be taken and construed to mean gas of any illuminating power, but of the purity required by general law as to illuminating gas and intended to be used for heating, cooking, chemical, mechanical and power purposes, and also for illuminating purposes by means of some substance inserted in the flame and thereby heated to incandescence.

The term "pipe line" shall be taken and construed to mean a line of mains, pipes or conduits, with the manholes and other apparatus necessary for the operation thereof, connecting a distributing system, plant for the manufacture of gas, or other pipe line, with any distributing system, plant, pipe line, town or city.

The term "distributing system" shall be taken and construed to mean any system of mains, pipes or conduits, in any city or town, with the manholes and other apparatus necessary for the operation thereof, used for distributing gas from any central storage receiving point or pipe line to individual consumers or for public lights in such city or town.

The word "Board" shall be taken and construed to mean the Board of Gas and Electric Light Commissioners.

SEC. 3. The capital stock of the Company shall be $5,000,000 divided into 50,000 shares of the par value of $100 each. The Company may from time to time, but in compliance with the provisions and requirements of the general laws of the Commonwealth applicable to the issue of capital stock, increase its capital stock above the amount fixed by this Act in such amounts as shall be approved by the Board. In addition to and in extension of the right of the Company now established by the general laws of the Commonwealth to mortgage its franchise and other property, it shall, but subject to all regulations and restrictions provided by law, have the authority to mortgage its property and franchises to be hereafter required. No business shall be transacted by the Company until the whole amount of its original capital stock has been subscribed for and 10 per cent. thereof has been paid in in the manner and subject to the regulations provided in Sections 47 and 48 of Chapter 106 of the Public Statutes, and a certificate of these facts has been filed as provided in Section 46 of said Chapter 106, and thereafter no personal liability shall attach to the officers or stockholders of the Company, except as prescribed in Section 60 of said Chapter 106.

SEC. 4. The Company may, for the purposes aforesaid, and subject to the conditions hereinafter set forth, lay, construct, maintain, repair and operate its pipe lines and distributing systems in, along, through, under, across or over any public or private ways, lands, water courses, railroads, railways, canals, bridges or subways; and may make such excavations and construct such works as may be necessary for the laying, construction, maintenance, repair, extension, operation and examination of such conduits, pipes, manholes and other apparatus, machinery and works; *provided, however*, that no conduit, pipe or main shall be laid longitudinally along the location of any railroad company without the consent of the directors of such company, but the Company may lay, construct, maintain and operate its conduits, pipes or mains across or under any such location at such times and under such reasonable regulations and restrictions as the Board of Railroad Commissioners shall prescribe.

SEC. 5. If the Company shall desire for its pipe lines the right to construct, maintain and operate the same in the streets, lanes and highways of any city or town, it shall petition the Aldermen or Selectmen therefor, stating the termini of such pipe line in such city or town with as much particularity and certainty as practicable, and stating the streets, highways and lanes in which the Company desires to locate such pipe line, and the Aldermen or Selectmen shall grant that location, or such other location in such streets, lanes and highways as they shall deem proper. In the event that said Aldermen or Selectmen shall for a period of 30 days refuse or neglect to grant a location, or if the Company is dissatisfied with the location granted, it may within 60 days thereafter appeal to the Board, who, after such hearing and notice as they shall deem proper, shall grant to the Company reasonable locations between said termini for such pipe line in the streets, lanes and highways of said city or town. Upon the granting of such locations by said Aldermen, Selectmen, or Board, the right of the Company to lay, construct, maintain and operate such pipe line in the location granted shall become absolute without further permission of any public authority. Similar rights as to other pipe lines in the same city or town may be procured by the Company in the manner aforesaid. The Company may, upon obtaining such locations, and subject to such reasonable regulations and restrictions in respect to the manner and time of conducting the work as said Aldermen or Selectmen shall prescribe, dig

up and open the ground in any of the streets, lanes and highways of said city or town so far as is necessary to accomplish the object of the corporation, but such grant shall not affect the right or remedy to recover damages for an injury caused persons or property by the doings of the Company. It shall put all such streets, lanes and highways which are opened by it in as good repair as they were when opened, and upon failure so to do within a reasonable time shall be deemed guilty of a nuisance. In constructing, maintaining, repairing or extending its distributing system in any city or town the Company shall be subject to all the restrictions, regulations and liabilities set forth in Section 75 of Chapter 106 of the Public Statutes, except as in this Act provided; and in the construction, maintaining, repairing and extending of its pipe lines and distributing systems it shall in all cases be subject to the restrictions, regulations and liabilities set forth in Sections 76 and 77 of said Chapter 106. If in making such excavations any water or gas pipes, sewers, drains, conduits, or other subterranean works are disturbed or interfered with the same shall, at the expense of the Company, be restored to as good condition as they were in before such excavation.

SEC. 6. When the Company is not able to obtain by agreement with the owner such land or easements therein as shall be reasonably necessary for the construction, maintenance, repair and extension of its pipe lines, it may take the same in the manner and subject to the regulations, restrictions and liabilities now prescribed by law where land is taken by a railroad company by right of eminent domain.

SEC. 7. The Company may purchase, lease or operate the works, distributing system and other property of any person, firm, corporation, town or city, engaged in the business of selling or distributing gas, or any portion of such works, distributing system or other property, upon such terms as may be mutually agreed upon and approved by the Board; and such person, firm, corporation, town or city, may sell or lease any of its works, distributing system or other property, to the Company as aforesaid; *provided, however*, that in case of any such purchase, lease or operating contract, the prices charged by the Company to individual consumers or for public lights shall not thereafter exceed the prices ruling at the time of such purchase, lease or operating contract.

SEC. 8. Any person, firm, corporation, town, or city, engaged in the business of distributing gas, may purchase gas of the Company and may contract with the Company for the purchase of gas for such terms of years and upon such terms and conditions as may be mutually agreed to. The price to be charged by the Company for the gas thus furnished by it, shall not exceed 35 cents per 1,000 cubic feet delivered to the holder or to the distributing system of such person, firm, corporation, city or town.

SEC. 9. Subject to the restrictions and regulations set forth in sections 75, 76 and 77 of chapter 106 of the Public Statutes, but not subject to the provisions of section 16 of chapter 314 of the Acts of the year 1885, the Company may, for the purpose of buying, selling, dealing in and distributing fuel gas only. lay, construct, maintain and operate its plant, works and distributing systems in any city or town in the Commonwealth. It may, subject to the restrictions and regulations of said sections 75, 76 and 77 of said chapter 106, lay, construct, maintain and operate, for the purpose of manufacturing, buying, selling and distributing illuminating gas, its plant, works and distributing system, in any city or town in the Commonwealth in which a gas company does not exist in active operation. If the Company incorporated by this Act desires to engage in the business of manufacturing, selling or distributing illuminating gas to individual consumers or for public lights in a city or town in which a gas company exists in active operation, it shall file with the Board an application for authority so to do, accompanied by such an obligation as shall be satisfactory to said Board to furnish to individual consumers and for public lights illuminating gas of equal purity and illuminating power to that furnished by the existing Company at the time of the application and at a maximum price or prices per 1,000 cubic feet to be stated in said obligation. If the existing Company shall give to said Board an obligation satisfactory to said Board to furnish gas of such purity and illuminating power to individual consumers and for public lights in said city or town at prices not exceeding those stated in the obligation of the Company, said Board shall refuse the application of the Company, otherwise it shall grant the same. If the Company shall commence the sale and distribution of illuminating gas in such city or town, it shall not thereafter charge a higher price for illuminating gas than the prices named in said obligation. If the existing Company shall reduce the prices of its gas as hereinbefore stated, it shall not thereafter increase the same. Nothing herein contained shall be construed as preventing the Company from making similar applications from time to time. *Provided, however*, that the authority granted to the Company by this section shall not avail it unless it begins the business of constructing its distributing system in said city or town within six months of the granting of said authority, and the business of selling to individual consumers or for public lights within 18 months thereafter, but if such construction or operation is interfered with by legal process, the time thus lost shall be added to said periods.

SEC. 10. The Company may charge and collect, but shall not exceed, in the following cases the following amounts per 1,000 cubic feet for gas, namely: For fuel gas delivered to any holder or distributing system, 35 cents; for fuel or illuminating gas distributed to individual consumers through a distributing system furnished and maintained by any other corporation or by any person, firm, city or town, 50 cents; for fuel or illuminating gas distributed by the Company to individual consumers through a distributing system owned, leased or operated by it, 35 cents, plus the actual cost of distribution, to be determined upon the application of any 20 consumers in said city or town by the Board, who shall include as a part of said cost the taxes on such distributing system, the legal rate of interest upon the actual cost to the Company of the distributing system, and a reasonable allowance for extensions, renewals, repairs and depreciation.

SEC. 11. The authority given to the Board by Section 5 of Chapter 346 of the Acts of the year 1886 shall not apply to the Company so far as its business relates to the manufacture, sale or distribution of fuel gas.

Nothing herein contained shall be construed to enable the Board to authorize the Company to engage in the business of selling electricity for light or power.

The Company shall not be regulated, in so far as it manufactures, distributes and sells gas for heating, cooking, chemical, mechanical and power purposee, by any provision of law relative to illuminating or candle power.

SEC. 12. This Act shall take effect upon the filing with the Treasurer of the Commonwealth, within six months from the passage of this Act, of a written paper duly executed and sealed by a majority of the incorporators named in section 1, or their successors, accepting the provisions of this Act, and covenanting for them, their associates and successors, to abide by all the terms, conditions and provisions thereof; and upon and in consideration of the filing of said covenant as aforesaid, and the construction by the Company of one or more pipe lines aggregating 25 miles in length within three years from the passage of this Act, the right to lay pipes, issue stocks, bonds and mortgages, hold property, sell and distribute gas, and all the other rights, privileges and franchises in this Act granted, shall not be interfered with or made subject to the imposition of any new tax, excise, duty, charge, reduction of price for gas, or other burden, before the year 1917, so long as the Company complies with the provisions of this Act.

The Company shall be entitled to receive from said Treasurer a certificate that said 25 miles of pipe line have been constructed in the manner and within the time in this section provided; and if said Treasurer declines to give such certificate, the Company may file a petition in the Supreme Judicial Court or Superior Court for the county of Suffolk for a decree ordering the issue of such certificate, and upon proof that at least 25 miles of pipe line have been constructed in the manner and within the time aforesaid, the court shall issue its decree ordering said Treasurer to sign and deliver such certificate to the Company. If the Company shall not within said period construct 25 miles of pipe line this Act shall be void, but if such construction is interfered with by legal process the time thus lost shall be added to said period; and if at any time after the expiration of said period the Company shall fail to operate at least 25 miles of pipe line for a period of two consecutive years, said failure shall be deemed a non-user of the franchises herein granted and the Attorney-General of the Commonwealth may thereupon institute proceedings for the forfeiture of this charter.

SEC. 13. The Supreme Judicial Court and any Justice thereof, and the Superior Court or any Justice thereof, shall have jurisdiction in equity, on petition of any party interested, to compel compliance with the provisions of this Act and to prevent any violations of the provisions thereof.

Wiped Joints.

In the plumbing line the skill required in making satisfactory wiped joints is greater than in anything else connected with the business, and many a man now following the trade prides himself on his ability to

make a good wiped joint, even if he may not be considered altogether capable in other lines. There is a great deal of knack in making a wiped joint, because it requires skill in handling the molten metal and a knowledge of the proper temperature at which it should be applied. The proper temperature is not determined by the mass of metal in the pot, but by the rapidity with which it is applied to the lead pipe, and the temperature of the whole when the wiping process begins.

Much good time has been put in learning to make a good smooth-wiped joint and to do it quickly. These points are all well known to those in the business, but what brings me to write about it now is that so many new devices are being put on the market to make such joints and connections mechanically and without the use of solder. There are devices in the shape of clamps and unions for making joints in straight pipes and connecting branches and all kinds of fittings where the plumber with his hot solder has always been required.

Judging from the description of the new device it would look as though anyone would be able to make all such joints as heretofore have been the pride of the plumber. The rage for cheapness of construction is probably to blame for such things being designed and put on the market, and it is probable that they will serve only as a makeshift for a time, because there is nothing so neat, so durable, so satisfactory and so safe as a good joint in a lead pipe made with solder and skillfully wiped down. Just compare one of those new-fangled fittings with a neat wiped joint where the brightness of the tin is contrasted with the deep black of the soil. Such a joint makes a better appearance than one composed of castings, intended to do away with one portion of the plumbers' art. Probably some one will yet devise a kind of machine that will supplant the plumber entirely, but unless he can put intelligence and the power of thought in it, journeymen plumbers need not fear losing their jobs.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

Mr. John Fox, of 160 Broadway, this city, announces that he has been succeeded in business by Mr. John Fox, Jr., and Mr. Nicholas Engel, Jr., under the firm name of Fox & Engel, with headquarters in the Postal Telegraph Building, 253 Broadway. They will deal, as did Mr. Fox, in cast iron gas and water pipe, valves, fire hydrants, lamp posts, and general supplies for gas and water companies.

Mr. Ogden B. Gillmor, who served the Norwich City (Conn.) Gas Company as Superintendent since April 18, 1863, resigned that post, the resignation taking effect on the 1st inst. Prior to his assuming charge at Norwich he had put in 12 years of active work at the plant of the old Brooklyn (N. Y.) Company. It is regrettable that the syndicate which recently acquired control of the Norwich Company could not see the way clear towards retaining Mr. Gillmor, for his record there was that of an efficient and painstaking official.

Manager L. L. Kellogg, of the Sioux City (Iowa) Gas Light Company reports that the increased sendout, following the new rate schedule promulgated January 1, 1896, is ample proof that the residents appreciate the liberality of the Company—the net rate in Sioux City now is $1.60 per 1,000. The Company is selling gas stoves at net cost, and makes all connections on gas stove account free of charge.

The Hospital Association, of Lansing, Mich., has thankfully accepted the generous offer of the Lansing Gas Light Company to furnish without charge therefor all the gas fixtures for the new hospital building. The Company also agreed to make the service connections to the building on an equally liberal basis.

Mr. E. Stein is no longer connected in a business capacity with Mr. J. Edward Addicks.

At the annual meeting of the shareholders in the Columbus (Ohio) Gas Company the following Directors were chosen: Emerson McMillin, W. H. Doane, C. D. Firestone, D. E. Putnam, N. B. Abbott, F. C. Hubbard, James Watson and Irvin Butterworth. The annual reports disclosed a most satisfactory increase in the Company's business; in fact, the profit therefrom was sufficient to warrant the Directors in declaring a dividend for the last half year of 3 per cent., which action virtually puts the stock on a 6 instead of a 5 per cent. basis.

The latest story from Chicago is this: In 1885 the Board of Managers of the Woman's Hospital, of Chicago, applied to the Chicago Gas Light and Coke Company for a gas meter, to measure the gas to be supplied to the Hospital building, at 32d street and Rhodes avenue. The meter was duly installed towards the close of May, 1885, and when no gas bill was presented in July for the gas used in June, the Managers concluded that the Company had determined to supply the gas on account of charity. About the middle of last April the meter refused to pass any gas, whereupon the Managers of the Hospital asked the present Company to send them a new meter. The gas folks could find no record on their books of the Hospital as a consumer, and subsequent investigation showed that the Hospital had been lighted free for something over 10 years, unwittingly by the Company. A computation of the arrearages showed the Hospital to be indebted to the Company in the sum of $11,000, but President Lincoln suggested as a basis of compromise that the sum of $1,000 be accepted in full payment for past dues, the future supply of gas to be charged for at the regular rate per 1,000. This, of course, was agreed to. In connection with this affair it is worthy of note that the Managers of the Hospital failed, in any one of the 10 years, to make formal acknowledgment of the Company's supposed generosity. It is also worth while to remember that the Company's inspectors failed to "spot" during the like period a non-recorded consumer, the consumption by which often exceeded 100,000 cubic feet per month.

Mr. J. T. Marsh, Superintendent of the Clinton (Mo.) Gas and Electric Company, reports that the manufacturing plant has been overhauled and that notable additions to the distributing system have been made. The Superintendent also declares that he will induce many more of the residents to try gas for cooking purposes, which assertion sounds rather courageous on his part, when one remembers that perhaps 75 householders of the place have been using gas on like account for some time.

Mr. George T. Thompson is no more the clever Superintendent of Station "B" of the Laclede Gas Light Company, of St. Louis, Mo., having resigned therefrom to accept a responsible position with Messrs. Emerson McMillin & Co., No. 40 Wall street, N. Y.

Amongst the betterments to its plant which the Akron (O.) Gas Company has decided upon is a standard double superheater Lowe apparatus, of the type built by the United Gas Improvement Company, its daily capacity being rated to a production of about 350,000 cubic feet. The old water gas works now in operation will be dismantled, and the new works, which will be thoroughly modern in every respect, will be rebuilt in another part of the city.

The New York Marine Paint Company's material continues to find favor with those who are concerned in the preservation of exposed iron work. Mr. James M. Hadden will be pleased to forward any information respecting the paint required by inquirers. Of course, his address is Poughkeepsie, N. Y.

Writing about Poughkeepsie further prompts us to say that Mr. Jno. Tracy, the Superintendent and Lessee of the Poughkeepsie Gas Light Company, has recovered from a serious illness. Only his grit carried him safely through the attack, which was all the harder because it was really the first time he had to deal with such a foe.

Mr. Charles Woodall has been transferred from the Paterson (N. J.) works to the plant at Ardmore, Pa., both of which properties are under the control of the United Gas Improvement Company.

In the action instituted by Mr. Thomas Hughes, to recover from the Malden and Melrose Gas Light Company, of Malden, Mass., the sum of $4,000 for personal injuries sustained by plaintiff on Nov. 27, 1894, while employed by defendant, in consequence of the caving in of a trench, the Court ordered a verdict for defendant.

The following officers were chosen by the stockholders of the Sandusky (Ohio) Gas Light Company at their annual meeting: Executive Committee, C.W. Sadler, John Homegardner, J. T. Mack, A. C. Moss, C. H. Moss, Geo. W. Paine and John Whitworth; President, C. W. Sadler; Vice-President, Geo. R. Butler; Secretary, C. H. Moss; Treasurer, A. C. Moss; Superintendent, Emil Schmidt.

According to the report of the official Inspector (Mr. Meeds), the gas supplied by the Minneapolis (Minn.) Gas Light Company during the month of April was well above the statutory requirements. The average candle power (26 tests) was 26; the sulphur content was 14.23 grains; the ammonia content was 0.33 grain; the maximum pressure was 2.24 inches; the minimum pressure was 1.63 inches. The average consumption of gas in the public lamps (average of 100 burners) was 5.81 cubic feet. Five meters were tested on complaints, one of which was found to be 4.65 per cent. fast; the others were accurate.

SPEAKING of the recent cut in the gas rate schedule for Concord, N. H., the Concord *Patriot* says: "The Concord Light and Power Company has voluntarily reduced the price of gas for lighting purposes from $2 to $1.50 per 1,000 cubic feet. The new rate is now in force, and the result of the action of the Company will be plainly apparent when the bills for May are presented. This is the heaviest cut made in the price of gas in the history of the corporation. In 1872 the price charged consumers was $3.20 per 1,000 cubic feet, and this was dropped, in 1876, to $3; in 1879, to $2.70; in 1883, to $2.40; in 1884, to $2.20; and in 1886, to $2. The object of the Company in making the reduction is to bring the product of its plant into more general use, and under the liberal policy adopted of delivering gas to the consumer's house—that is, laying the pipes in and connecting with the meter absolutely free of expense—with the cheapening of the price, the object sought should be easy of accomplishment. The price of gas is now the same for all purposes, thus doing away with extra meters. The Company, which is still a Concord institution, notwithstanding statements to the contrary, is seeking to bring its product into universal use in the city, and the management are confident that by bringing the price practically within the reach of all the capacity of their plant will be fully tested in the near future."

MR. JAMES J. WALWORTH, President of the Walworth Manufacturing Company, died at his home in Boston on the evening of April 28th. He was in his 88th year.

MR. O. O. THWING succeeds Mr. George T. Thompson in the Superintendency of Station B, Laclede Gas Light Company, St. Louis, Mo.

THE Fall River (Mass.) *Globe* has this to say about the movement to consolidate the gas interests of that city: "The proposed consolidation of the two local gas companies may entail legislative action, for the operations of gas companies are governed very largely by statute law, and there are many things a company cannot do with its own property. For example, it is not possible for one company to dispose of its rights to lay mains in certain thoroughfares, and except by the sale outright of the controlling stock to parties interested in another company, it is not possible to effect a consolidation. The Manufacturers' Gas Company became a defunct organization shortly after some of its stockholders' doings became known. A new Company was formed under the name of the Manufacturers' Gas Light Company, capital stock $50,000, and it is this Company, whose works are on Hartwell street, and whose rights the Fall River Gas Company would like to control. The Manufacturers' Company makes and distributes water gas. Within a few years the price of gas furnished to the mills has been squeezed down pretty low, but the Manufacturers' Company has declared dividends steadily. The last dividend declared brought the total amount paid out since the reorganization up to 200 per cent., or $100,000. It will thus be seen that the Company's franchise is an exceedingly valuable one, and it would undoubtedly be increased in value if modern methods of making gas were used. The Manufacturers' Company is not especially desirous of selling, nor is it particularly desirous of extending its lines or its service. Primarily it was established to furnish gas to the mills in the southeastern part of the city and because of the autocratic management of its competitor in the early days it did extend its lines through some sections that have since become thickly popu lated. The competition that resulted was beneficial to the consumer; but at the present time, when so many gas stoves are desired, and where the extension of the gas service is earnestly sought, the consumer is not getting all he wants. The men who own the controlling interest in the Manufacturers' Company will not part with their holdings until certain restrictive clauses in the proposed bargain are conceded. One of these is said to be the furnishing of fuel gas at the rate of $1 25 per 1,000 cubic feet, a reduction of 15 cents on the established rate of the Manufacturers' Company. Another is also said to be the granting of employment to Martin Dalton, who has worked for the Manufacturers' Company 23 years. These and other concessions may be made any day, and when they are made a connection will be made in Pleasant street with the pipes of the Manufacturers' Company, and all the gas will probably be made in the works at the foot of Anawan street."

THE Gas Light and Coke Company, of New Albany, Ind., has issued a mortgage in the sum of $100,000, the rate of interest thereon to be 5 per cent. per annum. The money is to be expended in refunding the existing indebtedness, and in paying for plant improvements.

THE Committee on Manufactures of the Massachusetts Legislature has reported leave to withdraw on the petition for legislation authorizing the Woburn Gas Light Company to purchase the property of the Arlington Gas Light Company in Winchester, and authorizing the Cambridge Gas Company to purchase the property of the Arlington Gas Light Company in Arlington and Belmont.

THE Franklin Light and Power Company, of Franklin Falls, N. H., has been organized to take over the properties of the Franklin Gas and Electric Light Company. The executive management of the new concern is: Chairman, A. W. Sulloway; Clerk, E. G. Leach; Treasurer, John P. Proctor.

MR. C. R. COLLINS has resigned the position of Manager of the Manhattan Incandescent Light Company, of New York, in order to take up anew the profession of gas engineering. His headquarters are in the New Jersey Central Railroad building, this city.

TOWARDS the close of last month Messrs. Martin Kalfish, P. Schortino, Geo. S. Bailey, W. T. Craft and B. E. Meeswender, of New York, representing the Globe Gas, Heat and Power Company, petitioned the Common Council of Yonkers, N. Y., for permission to lay gas pipes and mains through the streets of the city. They say they will furnish gas for illuminating purposes at the rate of 75 cents per 1,000 cubic feet, the rate for fuel gas to be 25 cents per 1,000. They also agree to file a bond in the sum of $25,000 that work will be commenced within 10 days after the franchise is granted.

THE Bristol County Gas and Electric Light Company is the title of the Company formed to operate the consolidated gas and electric lighting interests of Bristol and Warren, R. I.

MR. HENRY L. DOHERTY resigned the position of Superintendent of Distribution to the Columbus (Ohio) Gas Company, in order to accept the position of General Manager of the Madison (Wis.) Company.

AT the election in Cambridge, Mass., to determine whether or not the city should construct and operate on municipal account an electric lighting plant, the vote was 1,829 against; 1,180 in favor.

SUPT. H. K. MORRISON, of the Concord (N. H.) Light and Power Company, in speaking about the recent reduction in the gas rate for that city—the reduction is noted elsewhere in the items—said: "Our sole object is to make the use of gas more common about the city. There are 500 houses along our mains which to-day are unconnected. It is those which we hope to reach by this sweeping reduction. We have tried to give the residents of Concord a good service. We have made extensions wherever the people made any request for gas, and we are still extending the mains. In the near future pipes will be laid in Mills, Dakin, Glen, Highland, Albin, Pine, between Warren and Center, Tahanto streets, and others. We are ready to continue wherever we are given any encouragement by the residents. We hope that the new prices will be a benefit mutually to the consumers and the Company."

The Market for Gas Securities.

The main feature of the gas share market last week was dullness, the lack of bidders having been taken advantage of by room traders to mark Consolidated down to 161. We suppose it must be tiresome to our readers to hear the same old song every week, but we cannot help the measure of the music; for it is the common, plain truth that Consolidated is very cheap at the market price. In fact, if Equitable is worth 211, which is bid for it to-day (Friday), Consolidated ought to sell at 225, on the intrinsic merits of the two, and with due reference to the ultimate earning power of each. Mutual remains fairly firm, as do Standards and East Rivers. Brooklyn Union is 95¾ bid, and we may look for the announcement of a dividend now at any time.

The feature of the market for the week was a sharp rise in Bay State, which, on large transactions, sold up to 33, and reacted afterwards, the opening to day being made at 29¼ to 29½. The rise is attributed to a closing up of the differences between the Addicks and Rogers factions, the admitting of H. M. Whitney to the various Bay State Directorates rather going to show that the trouble is ended. One can't tell, however. Chicago gas is steady, at 69 to 69¼, and Baltimore is in good demand, at 64½ bid. Lacledes sold off sharply on the understanding that the decision of the Supreme Court in the matter of the franchise trial will not be handed down until some time in the summer. San Francisco is up to 93¼, on the announcement of the consummation of the agreement between the gas and electric lighting interests.

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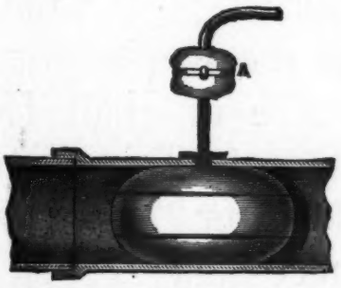

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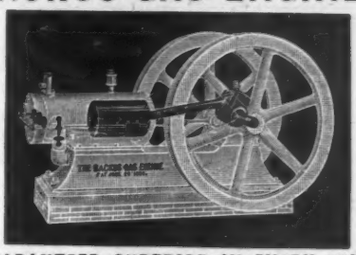

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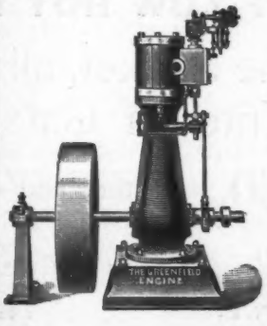

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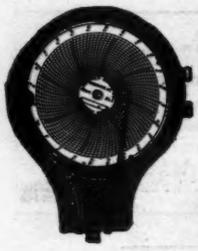
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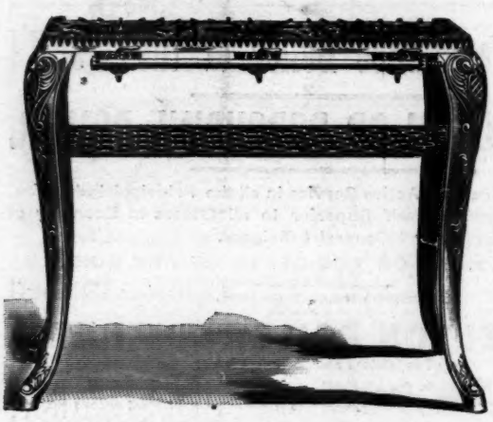
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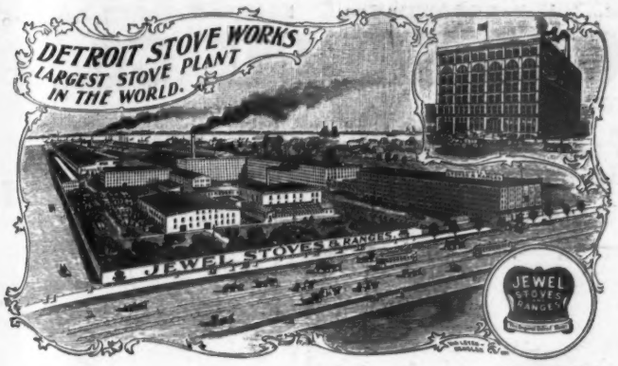

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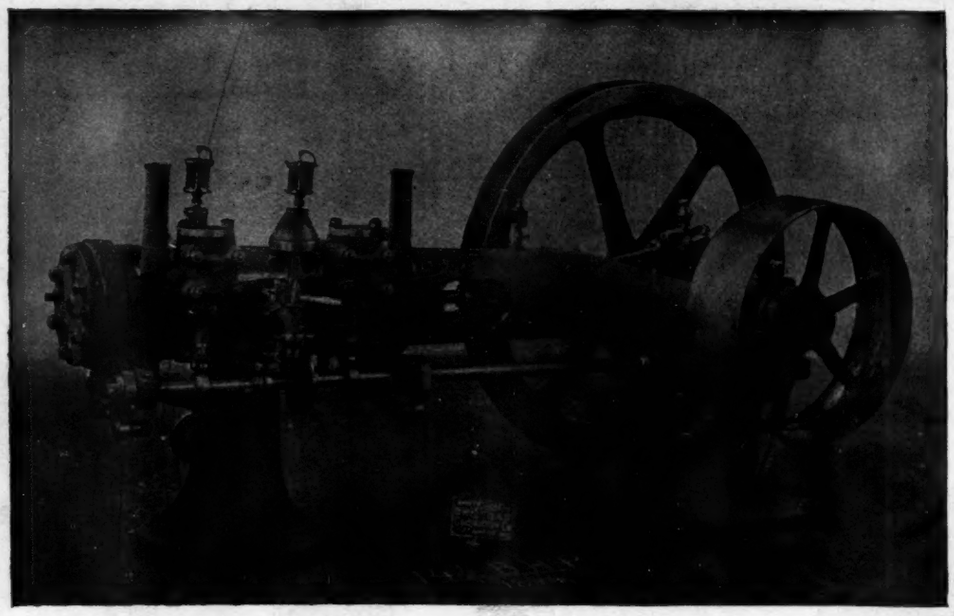
Under the Patents of Griffin, and Dick, Kerr & Co., of London and Kilmarnock.



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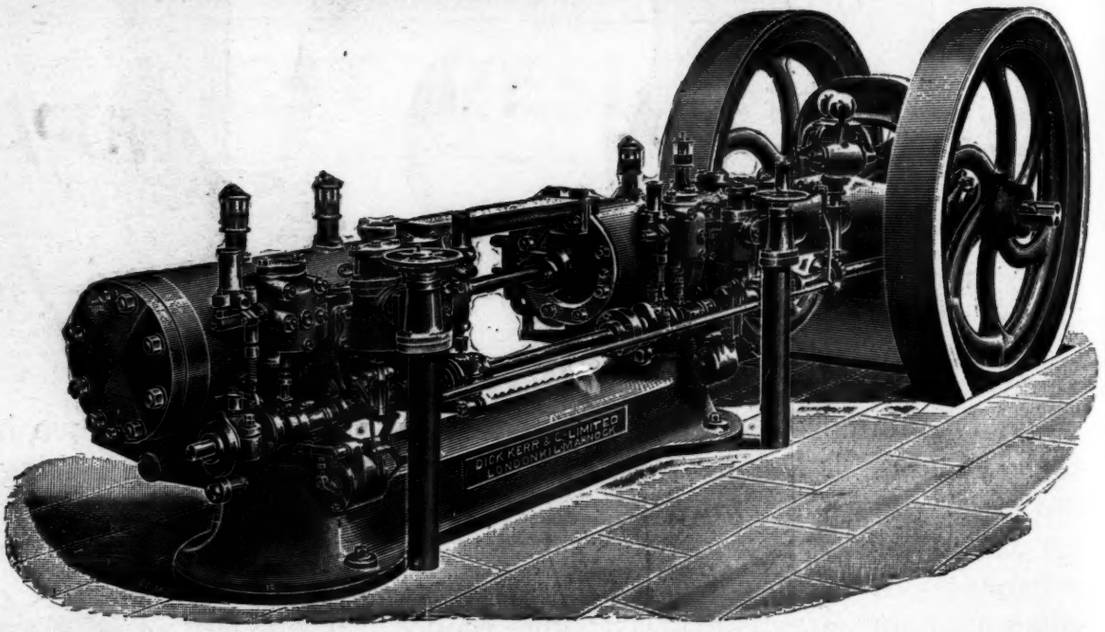

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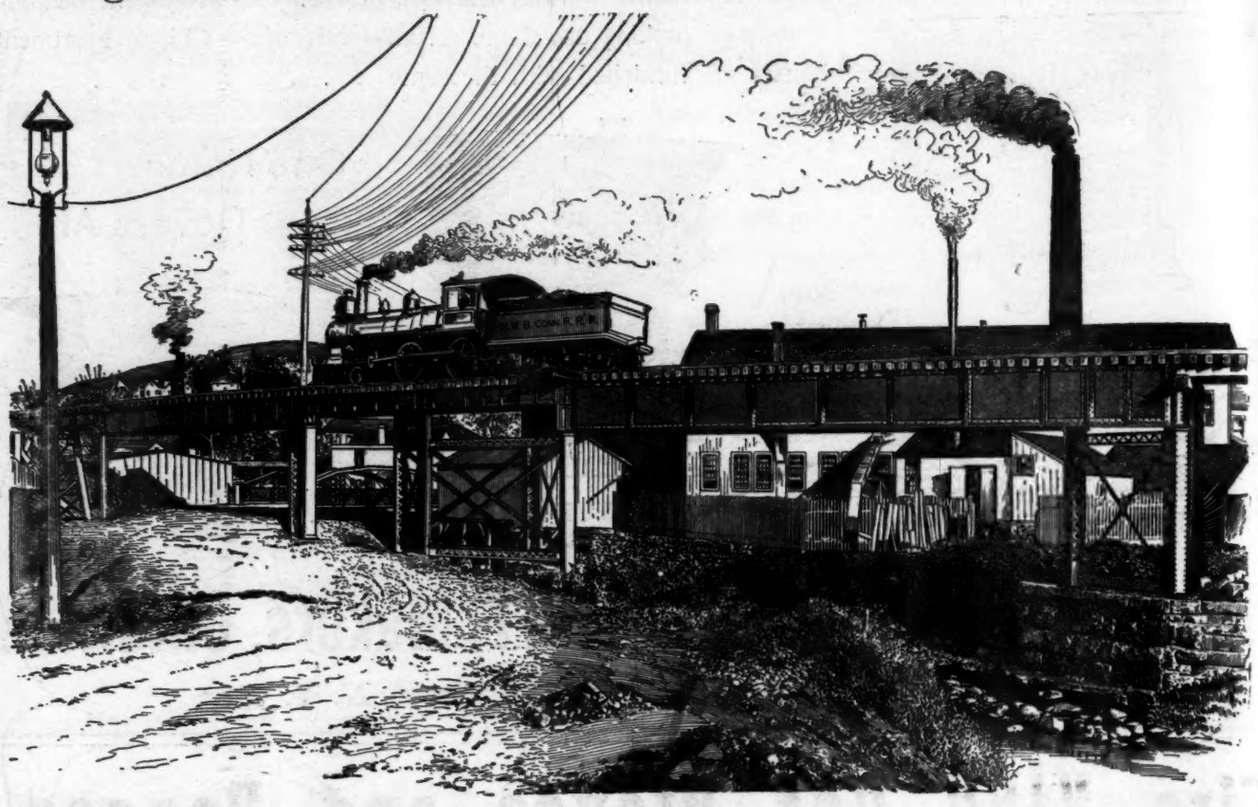

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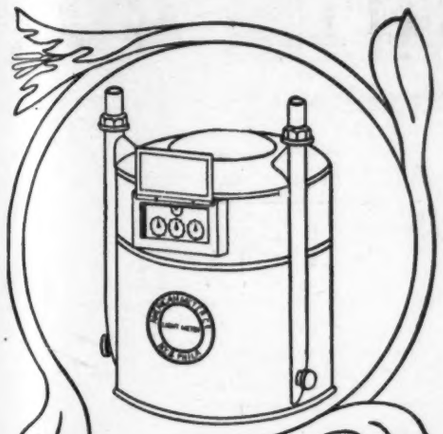

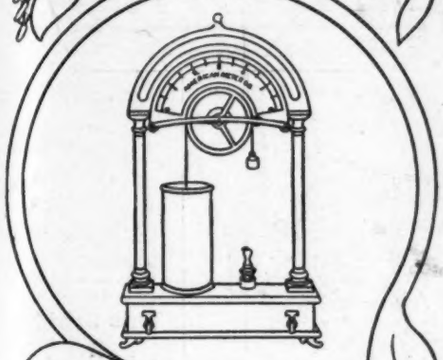

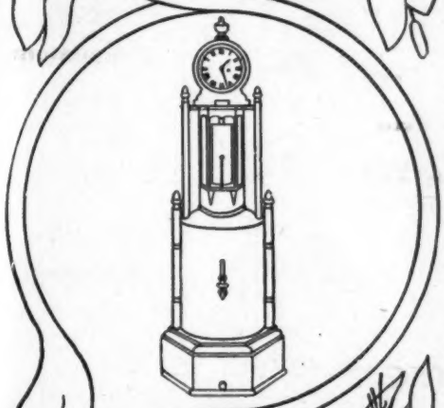

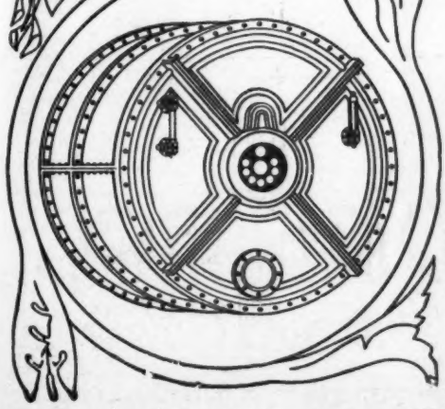

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NEW YORK AND PHILADELPHIA,

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SAN FRANCISCO.

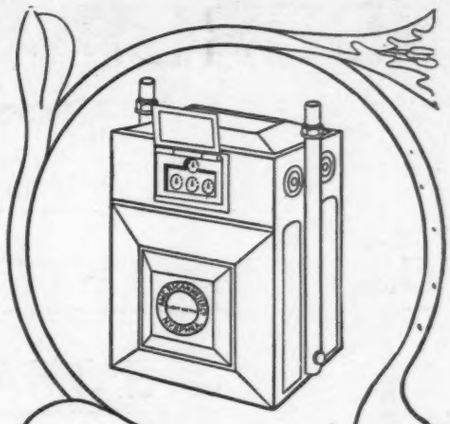
PUBLIC LIGHTING TABLE.

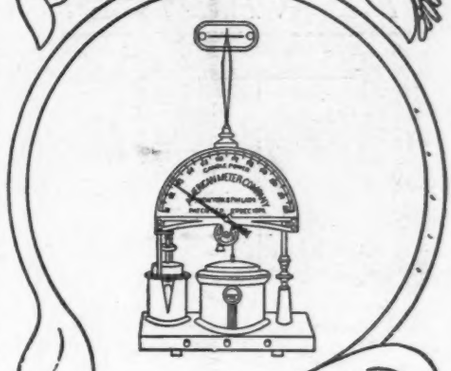
MAY, 1896.

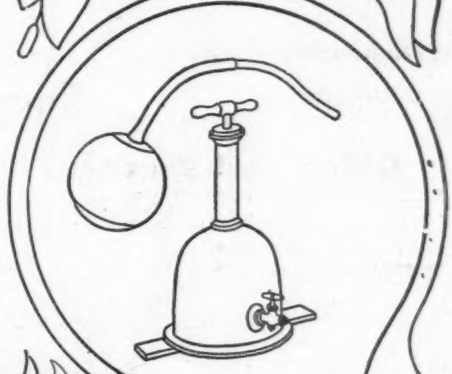
Day of Week.	Table No. 1. Following the Moon. Date.	Light.	Extinguish.	Table No. 2. New York City. All Night Lighting. Light.	Extinguish.
				P.M.	A.M.
Fri.	1	7.20 PM	1.00 AM	6.45	4.00
Sat.	2	7 20	1.40	6.45	4.00
Sun.	3	7.30	2.10	6.45	4.00
Mon.	4	7.30 LQ	2.30	6.45	4.00
Tue.	5	7.30	3.00	6.45	4.00
Wed.	6	7.30	3.20	6.45	4.00
Thu.	7	7.30	3.40	6.55	3.40
Fri.	8	7.30	3.50	6.55	3.40
Sat.	9	7.30	3.50	6.55	3.40
Sun.	10	7.40	3.50	6.55	3.40
Mon.	11	7.40	3.50	6.55	3.40
Tue.	12	7.40 NM	3.50	6.55	3.40
Wed.	13	7.40	3.50	6.55	3.40
Thu.	14	7.40	3.50	7.00	3.30
Fri.	15	7.40	3.50	7.00	3.30
Sat.	16	7.40	3.50	7.00	3.30
Sun.	17	10.50	3.40	7.00	3.30
Mon.	18	11.20	3.40	7.00	3.30
Tue.	19	11.50 FQ	3.40	7.00	3.30
Wed.	20	12.20 AM	3.40	7.00	3.30
Thu.	21	12.40	3.40	7.10	3.15
Fri.	22	1.10	3.40	7.10	3.15
Sat.	23	1.40	3.40	7.10	3.15
Sun.	24	2.10	3.40	7.10	3.15
Mon.	25	No L.	No L.	7.10	3.15
Tue.	26	No L. FM	No L.	7.10	3.15
Wed.	27	No L.	No L.	7.10	3.15
Thu.	28	7.50 PM	10.40 PM	7.15	3.15
Fri.	29	7.50	11.30	7.15	3.15
Sat.	30	7.50	12.10 AM	7.15	3.15
Sun.	31	7.50	12.40	7.15	3.15

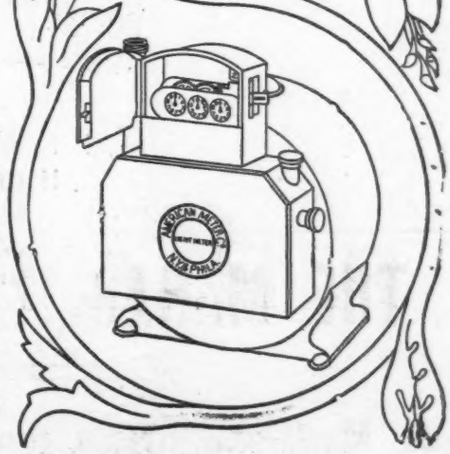
TOTAL HOURS LIGHTING DURING 1896.

By Table No. 1.	Hrs. Min.	By Table No. 2.	Hrs. Min.
January	220.40	January	423.20
February	207.00	February	367.40
March	193.00	March	355.35
April	174.10	April	298.50
May	164.00	May	264.50
June	142.10	June	234.25
July	142.10	July	243.45
August	150.50	August	280.25
September	163.00	September	321.15
October	193.10	October	374.30
November	207.00	November	401.40
December	237.30	December	433.45
Total, yr.	2194.40	Total, yr.	4000.00









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AUTOMATIC GAS GOVERNORS.

GAS VALVES. PIPE FITTINGS.

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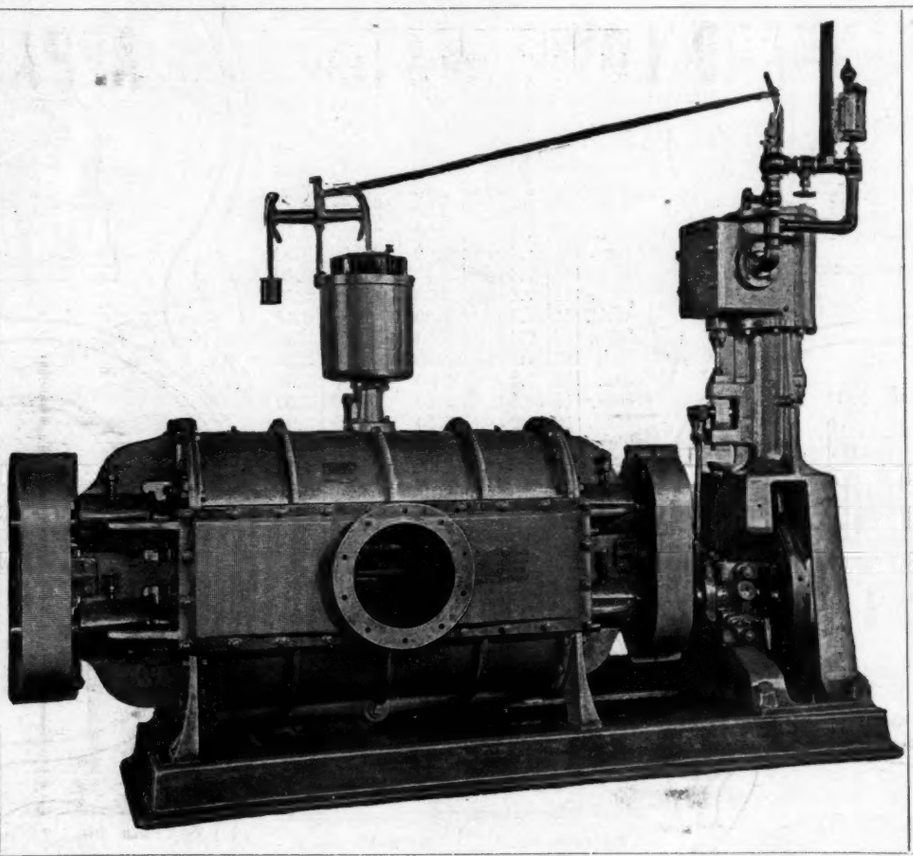

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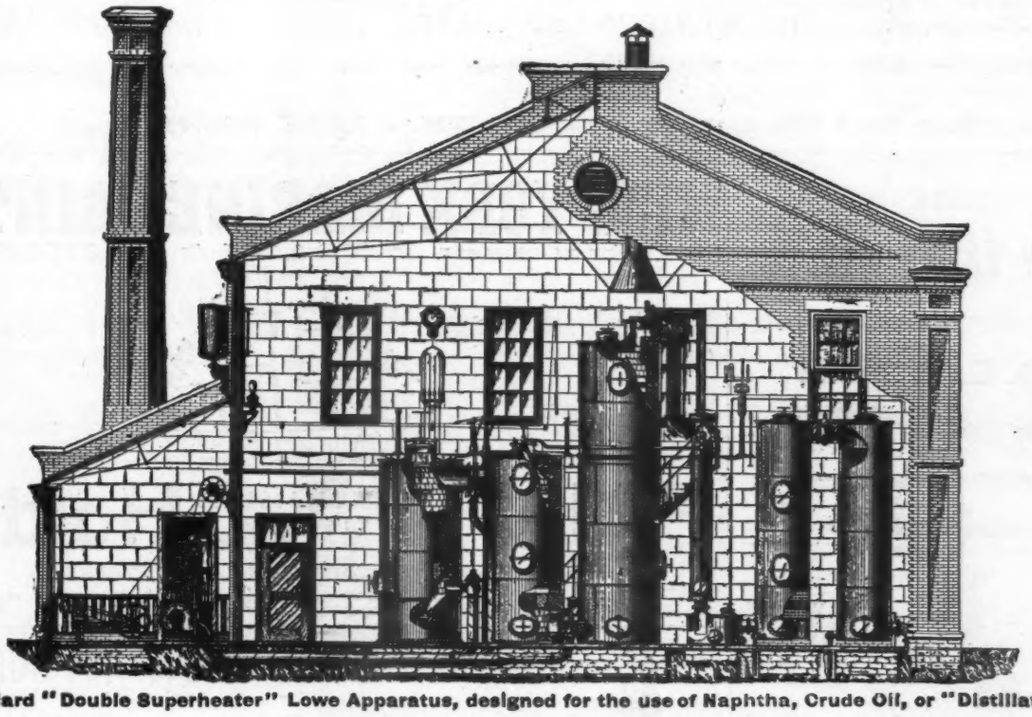

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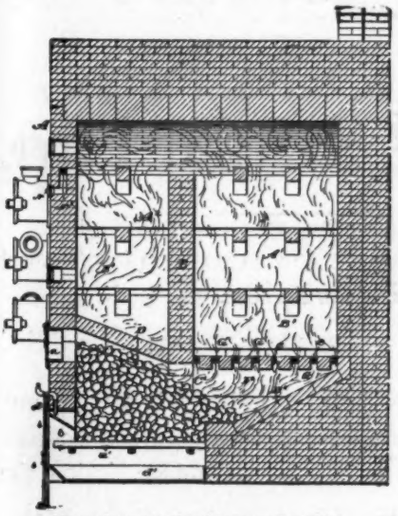

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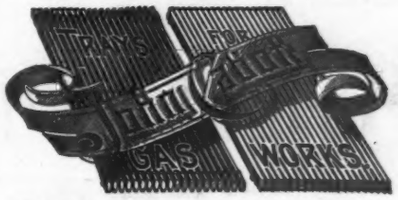

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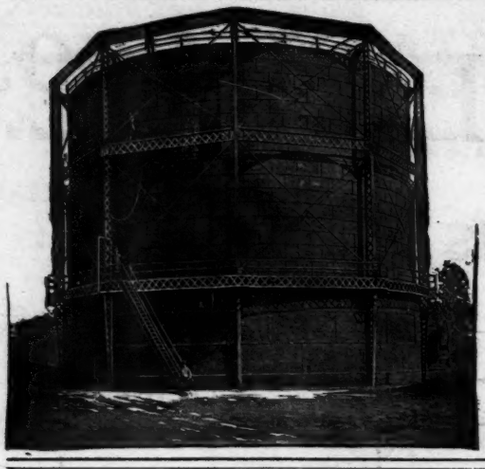

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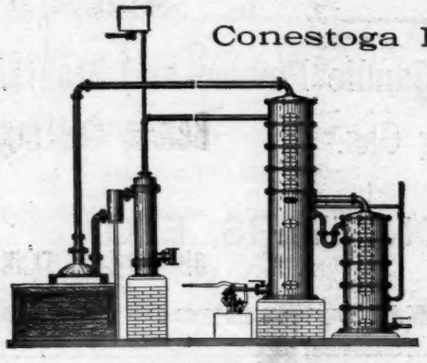

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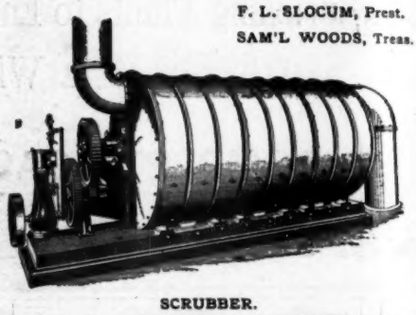

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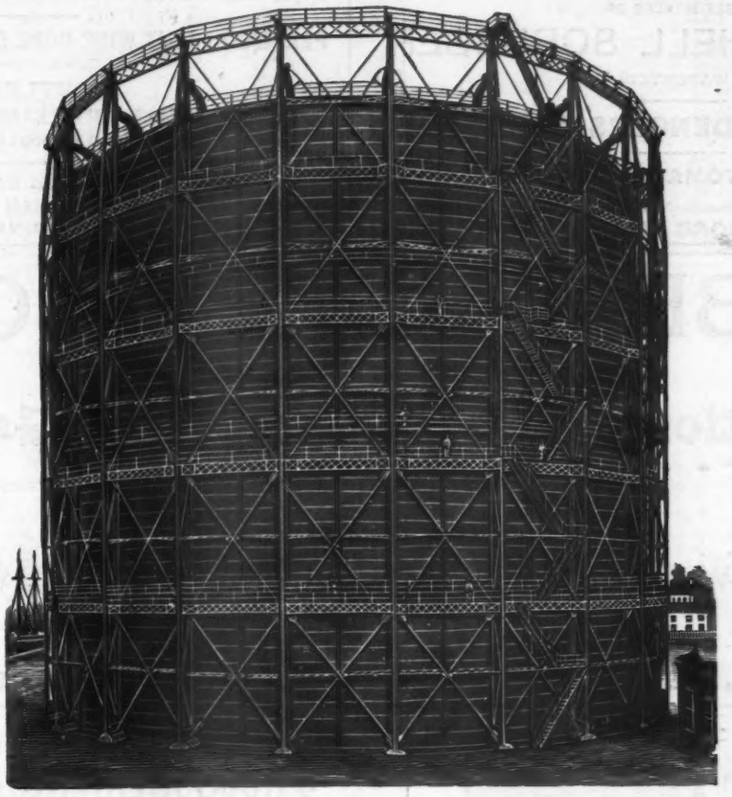

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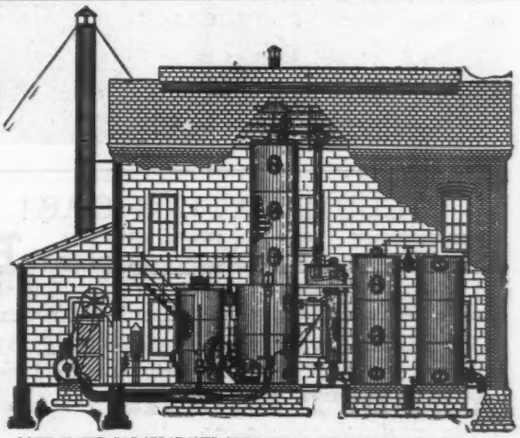

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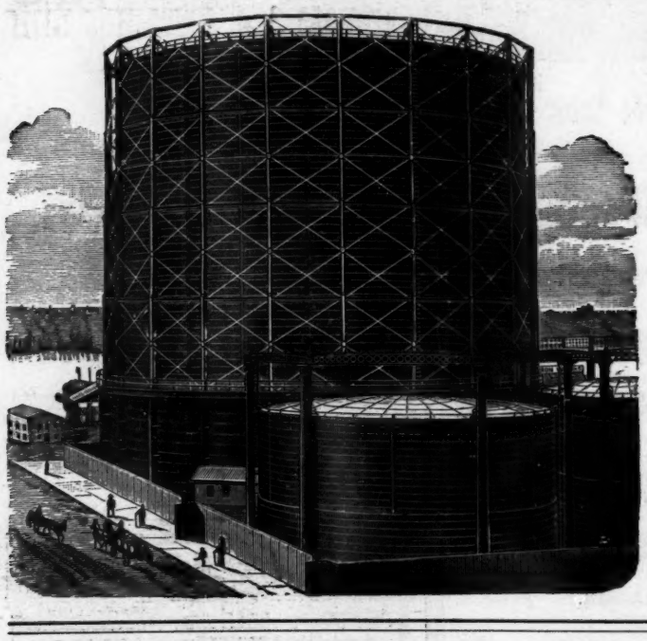

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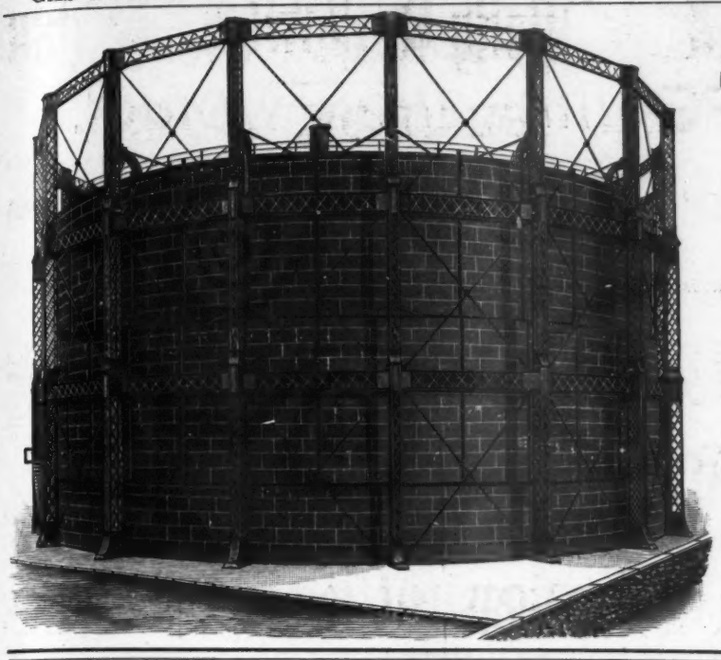

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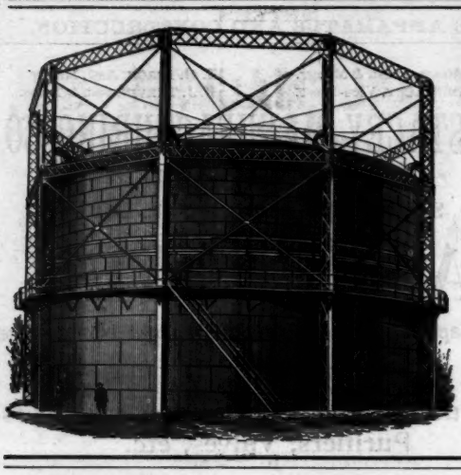

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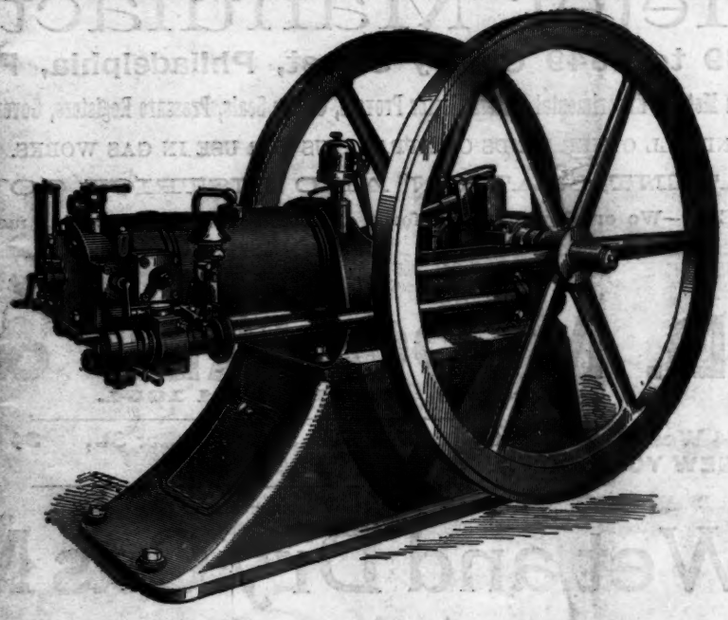

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